EXCHANGE RATE EXPOSURE OF U.S. INDUSTRIES

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EXCHANGE RATE EXPOSURE OF U.S. INDUSTRIES

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To my parents,

brothers, and sisters.

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I want to thank my committee, without whose invaluable advice, this thesis would not have been finished.

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SUMMARY

This thesis examines exchange rate exposure of 30 U.S. industries between 1974 and 2008 using traditional and orthogonalized linear models. Similar to the literature, when using traditional linear model we find that exposure is very time dependent and often insignificant. However, we discover that orthogonalization helps uncover more evidence of industry exposure. Within the orthogonalized linear model framework, we find that exposure is statistically and economically important, and the effect of orthogonalization is more pronounced for exposure to currency indices. We also test symmetry in exchange rate exposure by subdividing the sample period into the periods of appreciations and depreciations. Interestingly, we find little evidence that exchange rate is asymmetric even if we use orthogonalized linear model. Lastly, we discover that exchange rate exposure cannot be explained by our international trade data.

CHAPTER I

BACKGROUND INFORMATION, INTRODUCTION AND LITERATURE REVIEW

1.1 Background Information

1.1.1 Exchange Rate Exposure

As firms are engaged in international activities such as importing, exporting, and investing in foreign countries, they are exposed to the risk of exchange rate movements. Fluctuations in exchange rates can affect the settlement of contracts, cash flows, the firm's value, and its position in the market. As a result, exchange rate exposure which measures the sensitivity of the firm's stock returns to the exchange rate changes is an important issue for financial managers. It is conventional to classify exchange rate exposure into three types:

1. **Transaction exposure** can be defined as the sensitivity of domestic currency values of the firm's contractual cash flows denominated in foreign currencies to unexpected exchange rate changes. Transaction exposure arises when firms are engaged in fixed price contracts. To illustrate, suppose that a U.S. firm bought a product from its Japanese supplier who gave three-month credit terms and invoiced ¥100 million. When the U.S. firm pays the ¥100 million, it has to convert the dollars into Yens at the spot exchange rate on the maturity date. As a result, the actual dollar amount that it has to pay is unpredictable; should the Yen appreciate the dollar amount will be higher.

2. **Economic exposure** can be defined as exposure to unanticipated changes in exchange rates, which can have effect on the firm's competitive position in the international market and thus on its earnings, cash flows and foreign

investments. Suppose, for example, that the U.S. dollar appreciates significantly against the Japanese Yen. This change will hurt the U.S. auto industry as cars from Japan will be less expensive, and thus it would bolster the competitive position of Japanese car makers.

3. **Translation exposure** is defined as the risk that the firm's consolidated financial statements can be affected by changes of exchange rates. Suppose a U.S. firm has a subsidiary in the United Kingdom. This subsidiary will produce financial statements in British Pound. In order to consolidate financial statements worldwide, the firm must translate the financial statement from British Pound to U.S. dollar. Thus it is obvious that numbers in the consolidated financial statement will be based on the exchange rate movements of British Pound against the U.S. dollar.

1.1.2 Asymmetric Responses to Exchange Rate Movements

In most studies, exchange rate exposure is assumed to be symmetric, meaning that the firm value change symmetrically in response to appreciations and deprecations of domestic currency. For example, a net importer is assumed to benefit from appreciations of the domestic currency and suffer from deprecations of the domestic currency. However, firms' values often behave asymmetrically to changes of exchange rates for several reasons[1].

1. **Asymmetric exposure due to asymmetric price-to-market behavior** Pricing to market involves adjusting export prices based on the degree of competition in foreign markets. For example, exporters with an objective of maintaining their market shares will not allow foreign currency prices to increase

[1]See Koutmos and Martion (2003)

when the domestic currency appreciates. To avoid the risk of losing sales volume, they would maintain foreign currency prices and thus reduce their domestic profit margins. On the other hand, when the domestic currency depreciates, such exporters will lower foreign currency prices so that their sales volumes increase. Hence, cash flows would increase to a lesser degree with domestic currency depreciations than decrease with domestic currency appreciations.

2. **Asymmetric responses due to hysteretic behavior** Hysteresis refers to effects that persist after the original causes of the effects no longer exist. It is reasonable that new exporters are attracted to the market when the domestic currency weakens. However when the domestic currency strengthens, exporters may exhibit hysteretic behavior by remaining in the less favorable market to protect their high sunk-cost investments.

3. **Asymmetric responses due to asymmetric hedging behavior** A company's attempt to manage its exchange rate exposure is called hedging. Firms can hedge using various financial contracts and operational techniques. Examples are forward market hedging, option market hedging, choice of the invoice currency and exposure netting.[2] Since firms usually take one side hedges to prevent losses from macroeconomic shocks, the relation between firms' value and the exchange rate movements is often known to be asymmetric. For example, a firm with a long position[3] will usually hedge against the depreciations of the U.S. dollar and remain unhedged against appreciations. In an event of dollar appreciation, the firm will benefit; however, if the dollar depreciate, the firm will not suffer given that it is appropriately hedged.

[2]See Eun, C. and Redsnick (2005)

[3]Long position implies that the firm will benefit when the U.S. dollar appreciates and suffer when the it depreciates. For example, a firm that is expecting to pay a fixed amount of foreign currency to its supplier in the future is considered having a long position of U.S. dollar.

1.2 Introduction and Literature Review

The study regarding the relationship between foreign exchange rate movements and the value of the firm has been a contentious issue in the international financial economics literature. Dumas (1978) and Adler and Dumas (1980, 1984) suggest that exchange rate exposure can be defined as the sensitivity of stock returns to exchange rate movements. As discussed in the previous chapter, one would expect exchange rate exposure to be significant; however, many early studies suggest otherwise. For example, Jorion (1990) finds that only 15 out of 287 of U.S. multinational corporations exhibit significance at 5% level. Griffin and Stulz (2001) show that common shocks to industries across countries are significantly more important to firms' values than competitive shocks due to changes in exchange rates. He and Ng (1998) report that 25% of 171 Japanese multinational corporations have significant exposure.

Several studies have tried to explain this puzzle. There have been some studies that suggest nonlinear exchange rate exposure. Kizysand Pierdzioch (2007) examine exchange rate exposure by using nonlinear models with time-varying parameters. Their study shows that exchange rate exposure of Japan, the U.K. and the U.S. are nonlinear and vary over time. This finding is also consistent with Bartram (2004) who shows that the classical approach for exposure estimation appears to be unrealistic and too simplifying. There have also been studies that try to explain the role of foreign activities on the exchange rate exposure of a firm or an industry. Using data on U.S. companies, Jorion (1990) shows that exchange rate exposure is positively correlated with the degree of foreign involvement. Moreover, he finds low variability in exposure coefficients among firms with low or no foreign involvement. He and Ng (1998) suggest that the exchange rate exposure of a firm is determined by its level of export ratio as well as firm's hedging policy. Dominguez and Tesar (2006) examine correlations between exposure and firm size, multinational status, foreign sales, international assets, and competitiveness and trade at the firm and industry levels of eight

countries. They discover that for five out of the eight countries in the sample, over 20% of the firms are exposed to weekly exchange rate movements and that exposure at the industry level is generally much higher, with over 40% of industries exposed in Germany, Japan, the Netherlands and the U.K..

Bartov and Bodnar (1994) suggest that asymmetric exposure, among other complexities, might contribute to the failures of previous studies to show significant correlation between exchange rate and stock returns. There have been relatively few studies that address this issue. For instance, Choi and Prasard (1995) discover that approximately 60% of U.S. multinational firms with significant exposure benefited, and around 40% suffered, with a depreciation of dollar. Koutmos and Martin (2003) propose that asymmetric exchange rate exposure may occur due to asymmetric pricing-to-market behavior, hysteretic behavior, and asymmetric hedging behavior. They also provide empirical evidence that show asymmetric exposure in Germany, Japan, the U.K., and the U.S..

Recent studies also include Priestley and Ødegaard (2007) who study the exchange rate exposures by orthogonalizing the market returns with respect to exchange rate changes and a set of macroeconomic factors. They find that the extent of exposures is only fully revealed when we subdivide the sample period into regimes and simultaneously use an orthogonalized market portfolio in the regression[4]. Batram and Karolyi (2006) take a new look at the exposure puzzle by studying the potential impact of the introduction of the Euro on stock returns of 3,220 nonfinancial firms from 20 countries. They find that the introduction of the Euro decreased foreign exchange rate exposure, but these changes are statistically and economically small. Bae, Kwon, and Li (2008) study the exchange rate exposure and risk premium by using data on American depositary receipts (ADR)[5] of Australia, Japan, France and the U.K..

[4]See also Eq. (3)

[5]ADR represents a specified number of shares in a foreign stock that is traded on a U.S. exchange.

They show that the exchange rate changes are negatively correlated with the underlying share of ADRs, but positively to ADR returns observed in the U.S. markets. They also discover that U.S. and local investors require different risk premiums for exchange rate risk present in ADR investments.

This thesis examines exposure of thirty U.S. industry portfolios to movements in U.S. Dollar over the floating period by using monthly data. With few exceptions the literature typically uses exchange rate indices to examine the exposure. In this thesis you use both exchange rate indices as well as bilateral exchange rates. More specifically, we utilize an index that measures the value of US Dollar against the U.S.'s major trading partners and an index that is more broad in terms of coverage. We use two bilateral U.S. Dollar rates namely Euro-USD and Yen-USD rates. These two represent major trading blocks of the U.S. Use of both index and bilateral rates may uncover interesting results in terms of the degree and direction of exposure. Following the literature, we explore exposure first by running conventional regression models as well as a methodology that allows us to separate the entire sample into periods of appreciations and depreciations effectively and hence thereby allows us to study if the exposure of industry portfolios may have asymmetric behavior as such appreciations have different exposure profiles than depreciations in general. This is novel (to our best knowledge) as it has not been used in the exposure literature before. In order to address the endogeneity between portfolio returns and the exchange rate returns, following Priestley and Ødegaard (2007), we also use orthoganizled regressions in investigating the exposure of industry portfolios. In addition to asymmetry in exposure, we also investigate if there is variation across subsamples by splitting the sample into 6 subperiods, 1974-1978, 1979-1985, 1985-1990, 1991-1995, 1996-2001 and 2002-2008. To better visualize the variation of exposure across time, we also perform rolling regression of the traditional linear model with the window size of 60 months and plot the graphs of exposure for 11 industries for illustration.

Similar to the literature, we find that when using traditional linear regression in estimating exposure, there is little evidence of exchange rate exposure. When using the orthogonalization method proposed by Priestley and Ødegaard (2007), we find similar results to theirs in that we uncover more evidence of exposure. Our results also suggest that exposure is usually time dependent which is also consistent with previous studies. We however find little evidence about asymmetry of exposure both in the traditional model and orthogonalized model. For most industries, we cannot reject the null hypothesis that the exposure is symmetric. We also compare the trade data of a subset of the industries with the exposure results of these industries. We discover that an industry's exposure cannot always be explained by its trade data, at least by our data. For example, an industry which most heavily exports probably is not the most exposed industry.

CHAPTER II

METHODOLOGY

2.1 Traditional Linear Exposure

Adler and Dumar (1984) define firm-specific exchange rate exposure as the effect of exchange rate changes on the value of a firm after controlling for market movements. Thus exchange rate exposure of an industry can be measured by the following regression:

$$r_{it} = \alpha_{i0} + \beta_{im} r_{mt} + \sum_{j=1}^{n} \alpha_{i,j} x_{j,t} + \varepsilon_{it} \tag{1}$$

where r_{it} is the excess return on industry i at time t, r_{mt} is the excess return on the market portfolio, $x_{j,t}$ is the percentage change in j exchange rate, α_{i0} is a constant, and ε_{it} is the random error. Since one important characteristic of the stock return and interest rate data is the presence of heteroscedasticity, robust standard errors are used. $\alpha_{i,j}$, the slope coefficient, is the estimate of currency j exposure because it describes the sensitivity of stock returns to changes in currency j. However, interpreting $\alpha_{i,j}$ as exposure raises a problem. Since the market portfolio is an aggregation of individual industry stocks, if individual industries are exposed, so is the market. As Priestley and Ødegaard (2007) point out, $\alpha_{i,j}$ is not the total exchange rate exposure of industry i to exchange rate j, but rather the exposure of industry i over and above that of the market portfolio. Suppose for example that an industry has the same exposure as the market portfolio, estimation results from Eq. (1) would lead to a conclusion that the exposure of such industry is zero. This issue warrants an investigation since Dumas and Solnik (1995) has shown that market portfolios are exposed to exchange rate movements. To address this issue, we introduce orthogonalized linear exposure.

2.2 Traditional Linear Exposure with Macroeconomic Variables

In the section 2.3 we will discuss the orthogonalization method where four macroeconomic factors are added to the regression as independent variables. In order to see the effect of the method, we need to include the macroeconomic factors into the right hand side of Eq. (1) and rewrite it as follows:

$$r_{it} = \alpha_{i0} + \beta_{im} r_{mt} + \sum_{j=1}^{n} \alpha_{i,j} x_{j,t} + \mathbf{a_{mz} z_t} + \varepsilon_{it} \tag{2}$$

where $\mathbf{z_t}$ is a vector of macroeconomic variables, namely, changes in consumer price index, changes in industrial production, term spread and default spread[1]. The purpose of adding these variables into the regression is twofold. First, we can observe if the variables have explanatory power in the traditional exposure regression. Second, it allows us to see the effects of orthogonalization by comparing the exposure obtained from estimating Eq. (2), with that from Eq. (6) below.

2.3 Orthogonalized Linear Exposure

Following Priestley and Ødegaard (2007), we first orthogonalize the return of market portfolio on a set of changes of exchange rates:

$$r_{mt} = \sum_{j=1}^{n} \alpha_{i,j} x_{j,t} + u_{mt} \tag{3}$$

where u_{mt} is an error term which is defined as the orthogonal market return. That is the part of market portfolio return uncorrelated with the changes in exchange rates. Allayannis (1996) and Griffin and Stulz (2001) have employed this technique; however, they find that orthogonalization does not materially affect their results. Priestley and Ødegaard (2007) point out that orthogonalization in Eq. (3) is still inadequate since it

[1]Details on how we define and obtain these variables are discussed in chapter 3.

does not take into account the fact that the market portfolio return and the exchange rate may be related to some macroeconomic variables unrelated to exposure. In order to take these effects out of the market portfolio and exchange rate, we estimate the following regressions:

$$r_{mt} = \sum_{j=1}^{n} \alpha_{i,j} x_{j,t} + \mathbf{a_{mz} z_t} + u_{mt} \tag{4}$$

$$x_{j,t} = \mathbf{a_{mz} z_t} + u_{j,t} \tag{5}$$

where $\mathbf{z_t}$ is the vector of macroeconomic variables discussed in Section 2.2. Now u_{mt} is the orthogonal market portfolio return, and $u_{j,t}$ is the orthogonalized changes of exchange rate j. Priestley and Ødegaard (2007) argue that this methodology removes the correlation between exchange rates and stock returns caused by the macroeconomic factors. Now we can estimate the orthogonalized linear exchange rate exposure using the following regression:

$$r_{it} = \alpha_{i0} + \beta_{im} r_{mt} + \sum_{j=1}^{n} \alpha_{i,j} u_{j,t} + \mathbf{a_i z_t} + v_{it} \tag{6}$$

where $\alpha_{i,j}$ is the orthogonalized linear exposure of industry i to exchange rate j.

2.4 Testing Symmetry in Exchange Rate Exposure

To test for possible asymmetries in exposure, Koutmos and Martin (2003) extend traditional linear model by decomposing exchange rate change into its positive and negative components. This methodology is equivalent to subdividing the sample periods into those with positive and negative exchange rate changes. Bansal (1997) and Baillie and Kilic (2006) undertook similar decompositions. However, they use this approach to study forward premium puzzle. We define $x^{+}_{j,t} = Max(x_{j,t}, 0)$ and $x^{-}_{j,t} = Min(x_{j,t}, 0)$ and rewrite Eq. (1) as follows:

$$r_{it} = \alpha_{i0} + \beta_{im} r_{mt} + \sum_{j=1}^{n} (\alpha^{+}_{i,j} x^{+}_{j,t} + \alpha^{-}_{i,j} x^{-}_{j,t}) + \varepsilon_{it} \tag{7}$$

We decompose the orthogonalized exchange rate movements in a similar fashion; define $u^+_{j,t} = Max(u_{j,t}, 0)$ and $u^-_{j,t} = Min(u_{j,t}, 0)$ and rewrite Eq. (6) as follows:

$$r_{it} = \alpha_{i0} + \beta_{im} r_{mt} + \sum_{j=1}^{n} (\alpha^+_{i,j} u^+_{j,t} + \alpha^-_{i,j} u^-_{j,t}) + \mathbf{a_i z_t} + v_{it} \tag{8}$$

We can use Eq. (7) and Eq. (8) to test the null hypothesis that exposure is symmetric, i.e., $H_0 : \alpha^-_{i,j} = \alpha^+_{i,j}$ against the alternative hypothesis: $H_a : \alpha^-_{i,j} \neq \alpha^+_{i,j}$. Also we will test the null hypothesis that the joint null hypothesis that the exposure is zero and symmetric, i.e., $H_0 : \alpha^-_{i,j} = \alpha^+_{i,j} = 0$ against the null hypothesis $H_a : H_0$ is not true.

CHAPTER III

DATA AND DESCRIPTIVE STATISTICS

3.1 Exchange Rates

In this thesis we use the data on broad and major currency indices as well as bilateral exchange rates. The currency indices are weighted averages of the foreign exchange value of the U.S. dollar against a subset of the broad index currencies that circulate widely outside the country of issue. Broad currency index includes the Euro Area, Canada, Japan, Mexico, China, United Kingdom, Taiwan, Korea, Singapore, Hong Kong, Malaysia, Brazil, Switzerland, Thailand, Philippines, Australia, Indonesia, India, Israel, Saudi Arabia, Russia, Sweden, Argentina, Venezuela, Chile and Colombia. Major currency index includes the Euro Area, Canada, Japan, United Kingdom, Switzerland, Australia, and Sweden. Both currency indices are converted to the same base month, March 1997. Following the work of Priestley and Ødegaard (2007), we choose Japanese Yen and Euro as the bilateral currencies because Japan and Euro are major trading partners of the U.S. and their industries compete with those of the U.S.[1] We collected the data on exchange rates from the Federal Reserve Bank of St. Louis's website. Data on Japanese Yen and trade weighted exchange indices are available for the entire sample period. Data on Euro are available only after January 1999, the month in which the Euro was introduced. We however use the European community exchange rate (ECU) as the proxy for the Euro before 1999. ECU data are available from December 1978 to December 1998.

[1] According to Bureau of Transportation Statistics, Japan was the second largest trading partner of the U.S. between 1970's and 1990's and is currently listed as the fourth largest. Germany, United Kingdom, France and Italy have been consistently considered as major trading partners of the U.S. for the entire sample period.

Figure 1 plots the time series of the major currency index and the percentage change of the index. During the sample period, the dollar shows distinct periods of appreciations and depreciations. The dollar started to appreciate substantially around 1980 and reached its peak around 1985. This was due to high interest rates in the U.S. The increase in the value of the dollar was followed by a sharp depreciation which was caused by the high trade deficit and the Plaza Accord.[2] The dollar continued to depreciate until 1987 when it was stabilized briefly by government intervention. However, the devaluation resumed in the late 1980s. Then the dollar was relatively stable in the first half of 1990s and began to appreciate in 1995 and reach its second peak in 2002. This was followed by a period of depreciation from 2002 to the middle of 2008. This was probably caused by the increasing popularity of Euro in international transactions after 2001.

Figure 2 plots the time series of the broad currency index and its monthly percentage change. We can observe that the dollar started to appreciate in 1974 and peaked in 1985. This was followed by a slight depreciation until the dollar recovered just before 1990. Then there was a stable increase of dollar during 1990 to 2002. During 2002 to 2008, the dollar weakened continuously except for the spike towards the end of 2008.

Figure 4 shows the movements of the U.S. dollar per Euro. The movements of dollar relative to Euro are very similar to those of the major exchange rate index. This could be resulted from the fact that the majority of currencies in the exchange rate basket are in the Euro zone. Looking at Figure 3, we can see that the extent of dollar appreciation in the 1990s was much less relative to the Japanese Yen than to the exchange rate index. This is also the case for the period of dollar appreciation in the 1990s.

[2]Plaza Accord was an international agreement signed in 1985 in an attempt to devalue the U.S. dollar.

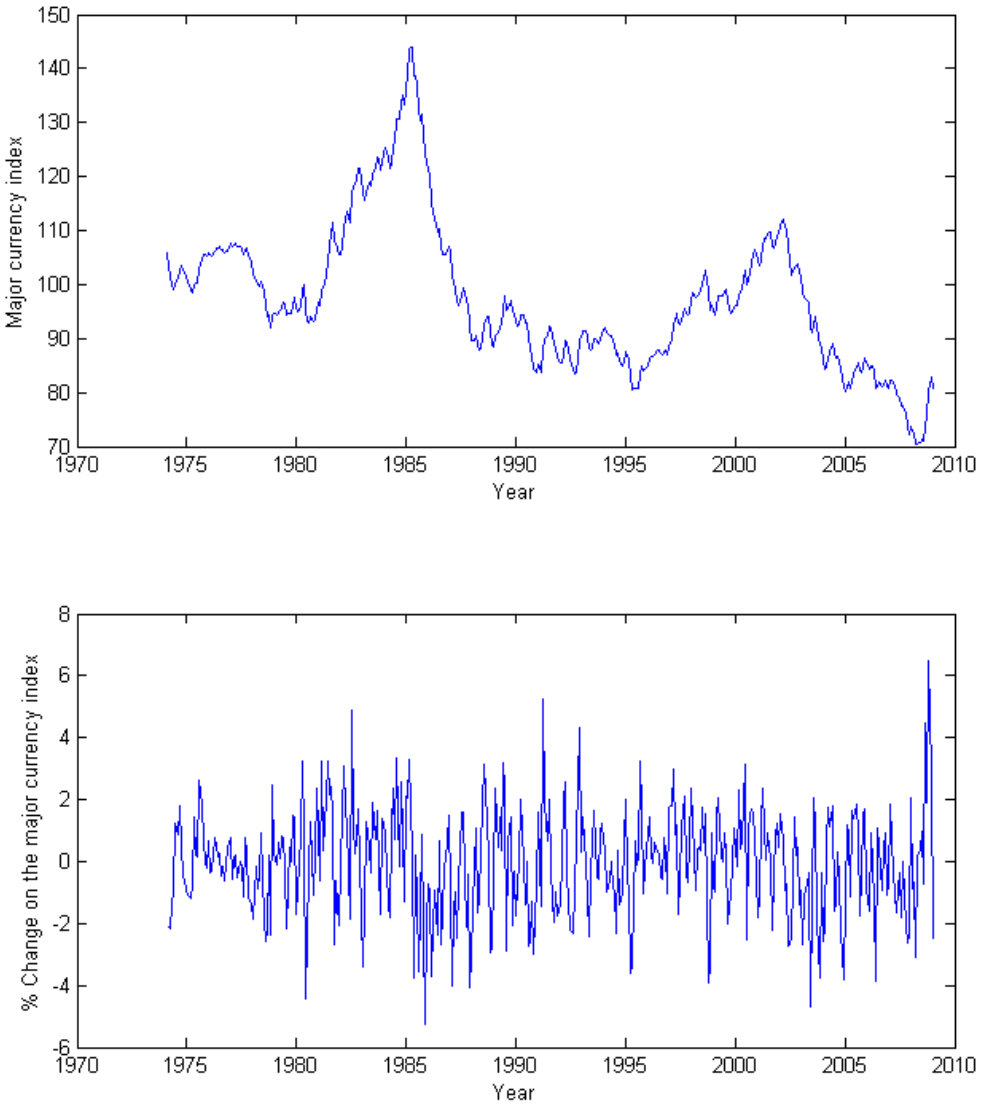

Figure 1: The time series plots of the major currency index and the percentage change of the index.

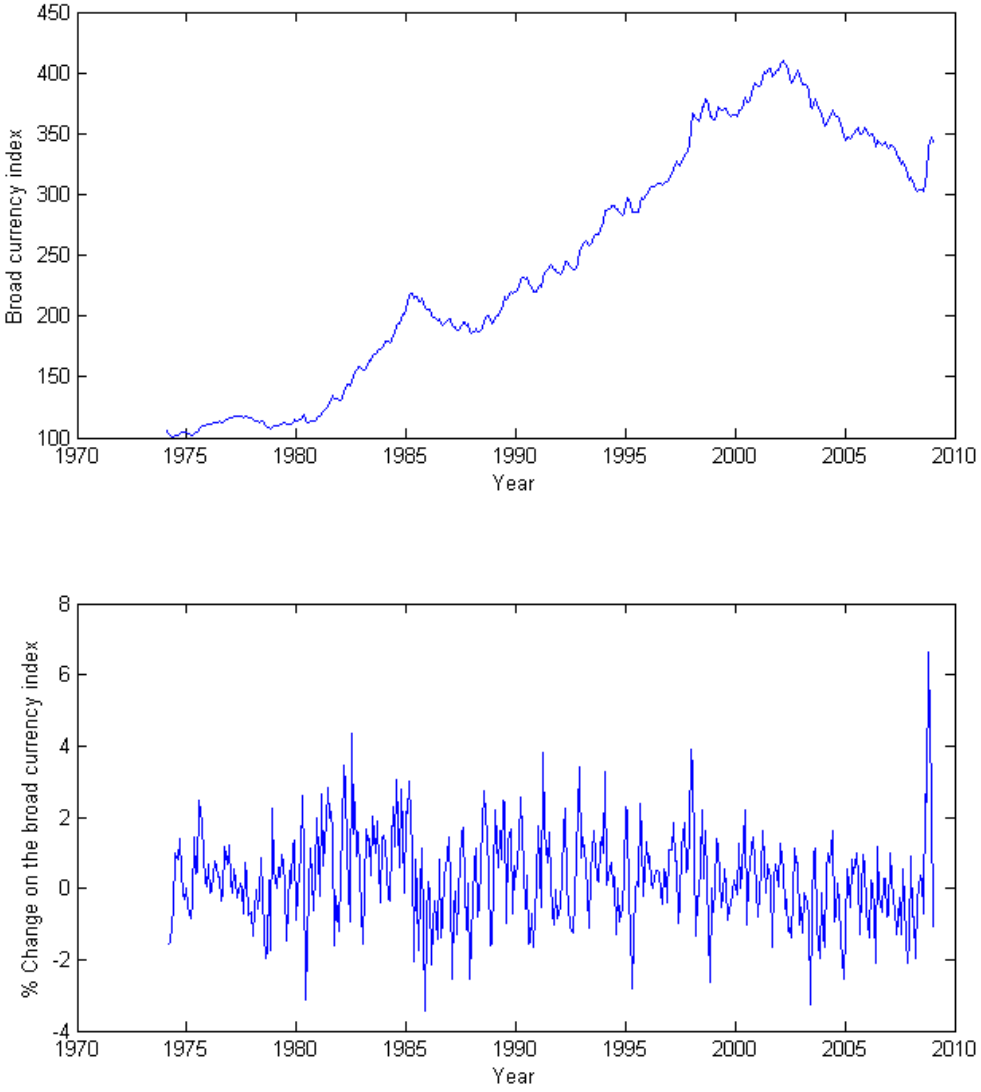

Figure 2: The time series plots of the broad currency index and the percentage change of the index.

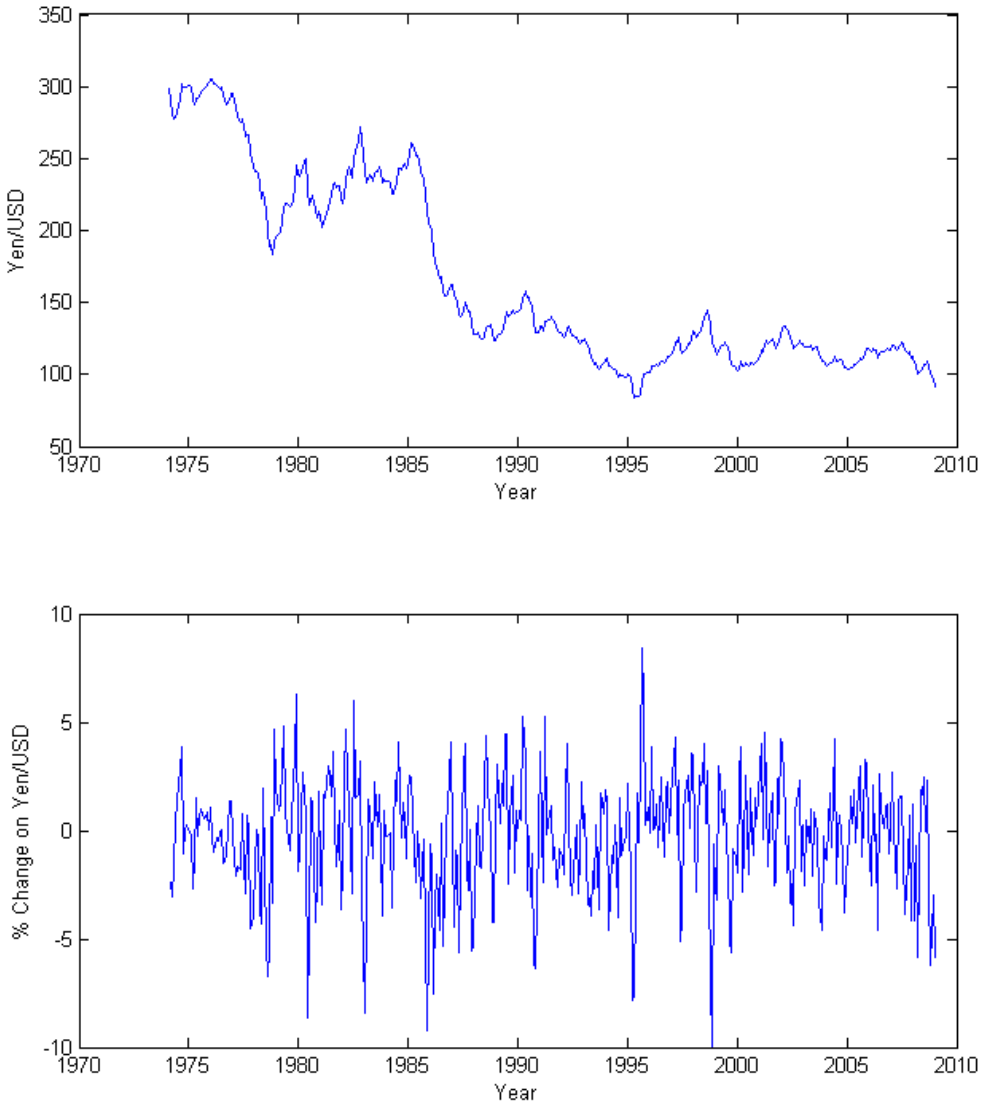

Figure 3: The time series plots of Yen/USD and the percentage change of the exchange rate.

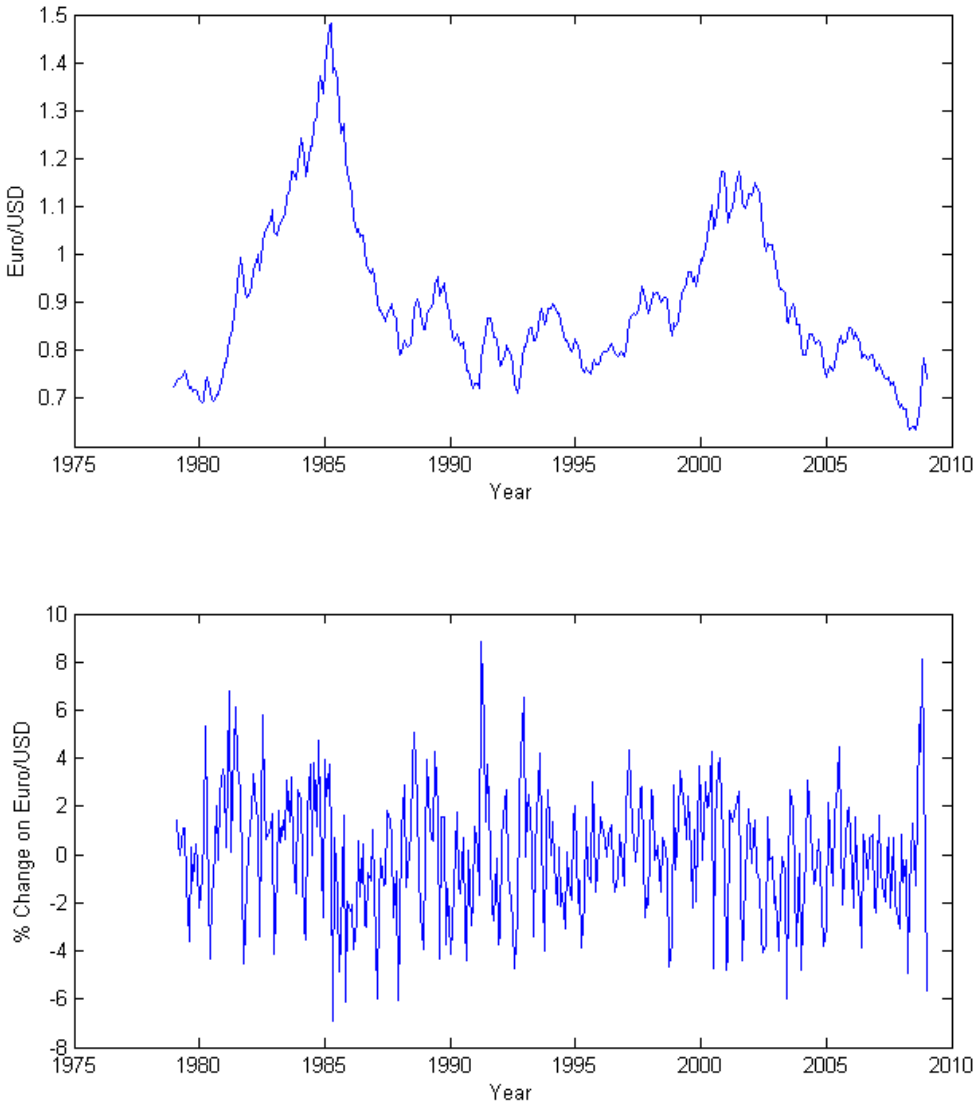

Figure 4: The time series plots of the Euro/USD and the percentage change of the exchange rate.

3.2 Industry and Market Returns

In this thesis, we investigate exchange rate exposure at the industry level. We collect value weighted stock returns of 30 U.S. industries provided by Kenneth French and Eugene Fama. They assign each NYSE, AMEX, and NASDAQ stock to an industry portfolio based on its four-digit SIC code at that time. We use the S&P 500 monthly return as the proxy for market return. The data are sampled over the period of January 1974 to December 2008. The excess return is defined as the return subtracted by the 3 month treasury bill rate. The treasury bill rate was also obtained from the Federal Reserve Bank of St. Louis's website.

Table 2 reports the summary statistics of excess returns for the 30 industries over the period of January 1974 to December 2008. Tobacco industry is the most profitable sector with average monthly excess return of 1.00%, and the least profitable are those categorized as "Others" with 0.27% average return. The most volatile industry is coal with a standard deviation of 10.39% for the excess return. Another interesting characteristic of the excess return data is the skewness. Returns of only four industries, namely, food, healthcare, coal, and petroleum are right-skewed. This characterized abnormal losses in most industries.

3.3 Macroeconomic Variables

As discussed in chapter 2, we also need a set of macroeconomic variables, namely, changes in consumer price index, changes in industrial production, term spread and default spread. We define term spread as 10 year treasury constant maturity rate subtracted by 3 month treasury bill rate. Default spread is defined as Moody's Baa corporate bond yield subtracted by Aaa corporate bond yield. All data are available for the entire sample period and obtained from the Federal Reserve Bank of St. Louis's website.

Table 1: Summary statistics of excess industry returns

Industry	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Food Products	0.68	4.69	-17.98	19.71	0.05	5.24
Beer & Liquor	0.69	5.71	-20.15	25.30	-0.05	5.08
Tobacco Products	1.00	6.61	-25.37	32.37	-0.05	5.67
Recreation	0.59	6.94	-33.36	30.45	-0.55	6.20
Printing and Publishing	0.45	5.50	-26.24	22.81	-0.32	5.52
Consumer Goods	0.40	4.97	-22.18	18.00	-0.26	5.04
Apparel	0.67	6.57	-31.37	31.87	-0.06	6.13
Healthcare, Medical Equipment, Pharmaceutical Products	0.53	5.22	-20.98	28.96	0.13	5.63
Chemicals	0.43	5.62	-28.47	21.65	-0.26	5.58
Textiles	0.45	6.51	-33.14	22.39	-0.77	6.55
Construction and Construction Materials	0.51	6.07	-29.19	25.30	-0.40	6.03
Steel Works Etc	0.34	7.65	-32.57	30.43	-0.29	5.57
Fabricated Products and Machinery	0.39	6.37	-31.71	21.92	-0.66	5.93
Electrical Equipment	0.72	6.40	-32.60	18.58	-0.32	4.99
Automobiles and Trucks	0.28	6.74	-36.58	22.03	-0.52	6.01
Aircraft, ships, and railroad equipment	0.78	6.46	-31.04	23.00	-0.42	4.91
Precious Metals, Non-Metallic, and Industrial Metal Mining	0.33	8.02	-34.33	34.69	-0.18	4.78
Coal	0.89	10.39	-38.13	45.79	0.36	5.25
Petroleum and Natural Gas	0.67	5.65	-19.21	23.26	0.06	4.43
Utilities	0.50	4.17	-12.88	18.28	-0.09	4.10
Communication	0.43	4.90	-15.95	21.99	-0.21	4.53
Personal and Business Services	0.67	6.91	-28.59	23.42	-0.15	4.17
Business Equipment	0.41	7.47	-32.15	24.40	-0.29	4.61
Business Supplies and Shipping Containers	0.37	5.31	-27.59	19.63	-0.20	5.71
Transportation	0.51	5.73	-28.58	18.58	-0.35	4.85
Wholesale	0.54	5.41	-29.18	17.29	-0.44	6.04
Retail	0.60	5.80	-29.80	26.56	-0.17	5.20
Restaurants, Hotels, Motels	0.62	6.08	-24.48	27.27	-0.28	4.94
Banking, Insurance, Real Estate, Trading	0.52	5.39	-22.38	20.40	-0.38	5.02
Others	0.27	5.72	-27.89	19.67	-0.43	5.10

Table 2: Summary statistics of macroeconomic variables

Industry	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Percentage Change of Consumer Price Index	0.36	0.38	-1.92	1.52	-0.30	6.44
Percentage Change of Industry Production	0.20	2.05	-5.24	5.65	-0.20	3.13
Term Spread	0.14	0.11	-0.22	0.37	-0.52	2.80
Default Spread	0.09	0.04	0.05	0.28	1.46	5.56

3.4 Import, Export and Market Capitalization

We obtained data on imports and exports from the Center for International Data at UC Davis. Data are available for only 21 industries from 1974 to 2006 as shown in Table 3. We assign each observation to an industry basket based on its four-digit SIC code. Data on market capitalization are available at Kenneth French's website. Even though data on imports and exports from 2007 to 2008 are not available, we assume that the lack of the data will not materially affect the ranking. We rank each industry based on 2 measures that characterize its international activities. Table 3 shows the ranking based on average normalized total international trade, defined as the average ratio of the sum of imports and exports to market capitalization of the industry in each time period. The concept of normalizing imports and exports data has been used by Chakraborty et al (2008). Table 4 reports the ranking based on average ratio of exports to imports in each time period. Looking at Table 3, we find that during the period 1974-2006 the apparel industry and the tobacco industry are the most and least trade intensive, respectively. We can also see that the rankings change quite significantly from period to period. This corresponds to changes in import and export values of each portfolio and changes in market capitalization of each industry. Considering the first column of Table 4, the industry that exports

most heavily compared to its imports during 1974-2006 is the coal industry. This holds true for almost every sub-periods except in the last sub-period.

Table 3: Industry Ranking Based on Normalized Import + Export

Industry	1974-2006	1974-1978	1979-1985	1985-1990	1991-1995	1996-2001	2002-2006
Food Products	9	4	4	9	12	9	11
Beer & Liquor	20	13	14	18	21	21	20
Tobacco Products	21	20	21	19	15	20	21
Recreation	10	8	9	8	9	10	12
Printing and Publishing	18	19	19	21	19	18	18
Consumer Goods	12	18	16	12	11	11	10
Apparel	1	1	2	1	2	1	3
Healthcare, Medical Equipment, Pharmaceutical Products	19	21	20	20	20	19	19
Chemicals	11	15	11	13	13	12	7
Textiles	3	5	5	4	6	2	2
Construction and Construction Materials	8	11	10	10	8	7	9
Steel Works Etc	4	7	3	6	5	4	4
Fabricated Products and Machinery	5	6	7	5	4	5	6
Electrical Equipment	15	12	12	17	16	17	5
Automobiles and Trucks	2	9	6	3	3	3	1
Aircraft, ships, and railroad equipment	7	3	8	7	7	6	8
Precious Metals, Non-Metallic, and Industrial Metal Mining	14	10	13	14	17	16	17
Coal	6	2	1	2	1	8	15
Petroleum and Natural Gas	16	14	15	16	18	15	13
Utilities	NA	NA	NA	NA	NA	NA	NA
Communication	NA	NA	NA	NA	NA	NA	NA
Personal and Business Services	NA	NA	NA	NA	NA	NA	NA
Business Equipment	13	17	17	11	10	13	14
Business Supplies and Shipping Containers	17	16	18	15	14	14	16
Transportation	NA	NA	NA	NA	NA	NA	NA
Wholesale	NA	NA	NA	NA	NA	NA	NA
Retail	NA	NA	NA	NA	NA	NA	NA
Restaurants, Hotels, Motels	NA	NA	NA	NA	NA	NA	NA
Banking, Insurance, Real Estate, Trading	NA	NA	NA	NA	NA	NA	NA
Others	NA	NA	NA	NA	NA	NA	NA

Table 4: Industry Ranking Based on Export/Import

Industry	1974-2006	1974-1978	1979-1985	1985-1990	1991-1995	1996-2001	2002-2006
Food Products	5	8	6	5	6	5	6
Beer & Liquor	19	20	21	19	19	18	18
Tobacco Products	2	2	2	2	2	1	1
Recreation	18	18	18	18	18	19	19
Printing and Publishing	6	10	8	6	4	6	7
Consumer Goods	17	15	14	17	17	17	17
Apparel	20	19	19	21	20	20	21
Healthcare, Medical Equipment, Pharmaceutical Products	8	6	7	7	8	9	11
Chemicals	4	5	4	4	5	4	4
Textiles	12	11	13	14	14	12	9
Construction and Construction Materials	14	12	12	13	13	14	15
Steel Works Etc	15	16	17	15	15	15	14
Fabricated Products and Machinery	7	4	5	8	7	7	8
Electrical Equipment	11	7	9	10	11	13	12
Automobiles and Trucks	16	14	16	16	16	16	16
Aircraft, ships, and railroad equipment	3	3	3	3	3	3	2
Precious Metals, Non-Metallic, and Industrial Metal Mining	13	17	15	12	9	8	5
Coal	1	1	1	1	1	2	3
Petroleum and Natural Gas	21	21	20	20	21	21	20
Utilities	NA	NA	NA	NA	NA	NA	NA
Communication	NA	NA	NA	NA	NA	NA	NA
Personal and Business Services	NA	NA	NA	NA	NA	NA	NA
Business Equipment	10	9	10	9	12	11	13
Business Supplies and Shipping Containers	9	13	11	11	10	10	10
Transportation	NA	NA	NA	NA	NA	NA	NA
Wholesale	NA	NA	NA	NA	NA	NA	NA
Retail	NA	NA	NA	NA	NA	NA	NA
Restaurants, Hotels, Motels	NA	NA	NA	NA	NA	NA	NA
Banking, Insurance, Real Estate, Trading	NA	NA	NA	NA	NA	NA	NA
Others	NA	NA	NA	NA	NA	NA	NA

CHAPTER IV

EMPIRICAL RESULTS

This chapter reports the results of estimating exchange rate exposure. First we discuss the results from estimation of traditional linear exposure in Eq. (1). To see the effects of macroeconomic factors, we also report the results from regressing excess stock returns on the macroeconomic factors, the market excess return and the changes of exchange rates as described in Eq. (2). Then we discuss the results from orthogonalized regressions as described in Eq. (6). In each model we report results from the estimation of exposure to the currency indices, Euro and Japanese Yen. We also report the results from testing symmetry in exchange rate exposure using the method described in section 2.4. At the end of this section, we also plot the graphs of exposure estimates of 11 industries using rolling regression method with the window size of 60 months.

4.1 Traditional Linear Exposure

4.1.1 Exposure to Euro and Yen

Tables 5, 6, and 7 report the results from estimating traditional linear exposure to Euro and Japanese Yen. More specifically, we estimate the exposure using Eq. (1) and use Japanese Yen and Euro as the set of exchange rates. The tables report results for each of the five subperiods and the entire sample. We examine economic significance of exposure coefficients by looking at the size of the coefficients and the change in the adjusted R^2 ($\Delta\bar{R}^2$) from adding the exchange rate changes to the regression.

Considering the entire sample period, 1979 to 2008, only three out of 30 industries

have significant exposure[1] to Euro, and only two industries are statistically exposed to the Japanese Yen. Sixteen industries have negative coefficients on changes of U.S. dollar against Euro, while eight industries have negative coefficients on changes of U.S. dollar against Japanese Yen. Roughly speaking, this implies that the U.S. industries benefit more from the appreciations of the U.S. dollar against Japanese Yen than from those of U.S. dollar against Euro. Coal industry is the only industry that is exposed to both currencies. The $\Delta\bar{R}^2$ of each industry is low with an average of 0.0019. Coal industry has the largest $\Delta\bar{R}^2$ of 0.021. It is interesting to note that the coal industry has negative significant exposure to Euro, while it is positively exposed to Japanese Yen. This means that it suffers when U.S. dollar appreciates against Euro and suffers when U.S. dollar appreciates against Japanese Yen.

Although Table 3 shows that apparel industry is among the most trade intensive industries, our results suggest that it is not exposed to Euro or Japanese Yen in any subperiod.

Considering the subperiods, we find that the number of industries that are exposed to the currencies changes significantly across the subperiods. In the first subperiod, 1979 to 1985, no industry is statistically exposed to movements of the U.S. dollar against Japanese Yen or Euro. On the other hand, seven industries are statistically exposed to the currencies during 1986 to 1990. Furthermore, one industry is exposed during 1996 to 2001 while six are exposed during 2002 to 2008. It is also interesting to note that the sign of exposure also changes significantly over time. For example, the coal industry is negatively exposed to Euro in the first and the last two subperiods and is positively exposed to the currency in the second and third subperiod.

In conclusion, using traditional linear exchange rate exposure model, we find that

[1]We consider an industry as significantly exposed if the estimated exposure is significant at 5% level.

few industries have statistically significant exposure coefficients and exposure is generally not economically significant.

4.1.2 Exposure to Broad and Major Currency Indices

Tables 8 through 11 report the results of the estimates of linear exchange rate exposure to broad and major currency indices. Considering the entire sample, 1974 to 2008, seven industries are statistically exposed to broad currency index movements and three industries are exposed to major currency index movements. For most industries, the signs and the sizes of the coefficients of both indices are consistent in both regressions. The average $\Delta\bar{R}^2$ in both regressions are almost the same at approximately 0.002. Similar to the those we get from estimating of exposure to Euro and Japanese Yen, the exposure coefficients change signs across the subperiods. The number of industries that are exposed to the broad currency index in each subperiod ranges from one to five. On the other hand, the number ranges from zero to six in the case of major currency index. If we consider the entire sample period, we can see that precious metal industry and coal industries are the most statistically and economically exposed industries to the broad currency index. On the other hand, the top two industries in the case of major currency index are precious metal and retail industries.

These results however are not consistent with our trade data in that the precious metal industry is ranked in the middle by average normalized total international trade and export-import ratio. In summary, similar to the bilateral exchange rate case, only a few industries are found to have statistically or economically significant exposure to the currency indices. Moreover, exposure coefficients of most industries vary both in size and sign over time.

4.2 Orthogonalized Linear Exposure

4.2.1 Exposure to Euro and Yen

Table 12, 13, and 14 report the estimates of orthogonalized linear exposure to Euro and Japanese Yen which is discussed in section 2.3. Considering the results of the entire sample period, we find that 12 industries are statistically exposed to Euro as opposed to three industries when using traditional linear model. Additionally, six industries are found to have significant exposure to Japanese Yen; on the other hand, only two industries are found to be significantly exposed to the currency when using unorthogonalized linear model. On average, $\Delta\bar{R}^2$ is 0.006, triple that of the traditional linear model. Coal industry remains the most statistically and economically exposed industry to both currencies with relatively high $\Delta\bar{R}^2$ of 0.026. Considering the results for subperiods, we find that more industries are exposed to both Euro and Japanese Yen when compared with the results from traditional linear regression. The signs of exposure also change across subperiods. It is also interesting to note that, for those industries that are statistically exposed, orthogonalization seems to yield higher coefficients in size.

4.2.2 Exposure to Broad and Major Currency Indices

The estimates of exposure to Broad and Major currency indices are reported in Tables 15 through 18. Looking at the results for broad currency index of the entire sample, 1974 to 2008, we find that 28 out of 30 industries are statistically exposed to the broad currency index. Moreover all the coefficients are significantly larger than the those we obtain from estimating nonorthogonalized model. Most of the exposure coefficients are also economically significant with the average $\Delta\bar{R}^2$ of 0.015 as opposed to 0.002 in the traditional linear model. Considering the estimates of exposure to the major currency index as reported in Table 17, we find that 23 out of 30 industries are statistically exposed to the currency index. The average $\Delta\bar{R}^2$ is 0.010, significantly

higher than that of the traditional linear model. It is also important to note that all the industries have negative exposure to both currency indices. This finding suggests that U.S. industries generally suffer from an appreciation of U.S. dollar.

4.3 Symmetry Testing: Traditional Linear Exposure

This section reports the results obtained from estimating Eq.(7) as well as the results from testing the null hypothesis that the exposure is symmetric. As discussed in section 2.4, decomposing exchange rate movements into positive and negative components is equivalent to subdividing the sample period into those with positive and negative exchange rate changes. Thus if the null hypothesis that the exposure is symmetric is rejected for a given industry and a given currency, it implies that the exposure of the industry to the currency depends on whether the dollar is appreciating or depreciating.

4.3.1 Exposure to Euro and Yen

The results from estimating Eq. (7), using Japanese Yen and Euro as the set of exchange rates, are reported in Table 19. The sixth and seventh columns show the F-statistics and the P-values from testing the null hypotheses: $H_0 : \alpha_{€}^{-} = \alpha_{€}^{+}$ and $H_0 : \alpha_{¥}^{-} = \alpha_{¥}^{+}$, respectively. In the case of exposure to Euro, we find that we can reject the null hypothesis at 5% significant level [2]only for two industries, financial and fabricated product industries. On the other hand, we cannot reject the null hypothesis that the exposure to Japanese Yen is symmetric for any industry.

4.3.2 Exposure to Broad and Major Currency Indices

Tables 20 and 21 report the estimates of exposure to broad and major currency indices using the model described in Eq. (8). We also report the results from testing

[2]We set our significant level at 5%

Table 5: Linear Exposure to Japanese Yen and Euro

Industry	1979 to 2008					1979 to 1985				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.085	(0.085)	0.006	(0.072)	0.003	0.126	(0.140)	-0.182	(0.137)	0.011
Beer & Liquor	-0.201*	(0.115)	0.080	(0.106)	0.007	-0.301*	(0.161)	0.226	(0.170)	0.017
Tobacco Products	-0.035	(0.165)	0.030	(0.122)	0.000	0.259	(0.202)	0.070	(0.171)	0.032
Recreation	-0.007	(0.115)	0.169	(0.109)	0.005	-0.134	(0.161)	0.416*	(0.218)	0.028
Printing and Publishing	-0.012	(0.091)	0.174**	(0.086)	0.008	0.054	(0.148)	0.017	(0.152)	0.001
Consumer Goods	0.082	(0.086)	-0.052	(0.092)	0.002	0.233	(0.147)	-0.171	(0.127)	0.013
Apparel	0.094	(0.115)	0.137	(0.102)	0.007	-0.138	(0.156)	0.180	(0.172)	0.005
Healthcare, Medical Equipment, Pharmaceutical Products	-0.110	(0.092)	0.062	(0.080)	0.003	-0.058	(0.144)	0.092	(0.134)	0.002
Chemicals	-0.078	(0.090)	0.051	(0.079)	0.001	-0.106	(0.119)	-0.035	(0.120)	0.004
Textiles	-0.030	(0.141)	0.234*	(0.133)	0.009	-0.146	(0.170)	-0.003	(0.155)	0.006
Construction and Construction Materials	-0.100	(0.100)	0.045	(0.088)	0.001	0.015	(0.136)	-0.111	(0.125)	0.003
Steel Works Etc	-0.169	(0.138)	0.037	(0.118)	0.002	-0.055	(0.202)	-0.139	(0.207)	0.006
Fabricated Products and Machinery	-0.085	(0.101)	0.003	(0.095)	0.001	0.097	(0.117)	-0.208*	(0.119)	0.008
Electrical Equipment	-0.029	(0.082)	0.026	(0.074)	0.000	0.059	(0.146)	-0.010	(0.121)	0.000
Automobiles and Trucks	0.167	(0.157)	-0.039	(0.135)	0.003	0.408*	(0.229)	-0.221	(0.213)	0.023
Aircraft, ships, and railroad equipment	0.126	(0.100)	0.017	(0.090)	0.003	-0.074	(0.199)	0.355*	(0.187)	0.016
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.396**	(0.189)	-0.057	(0.185)	0.018	-0.388	(0.302)	-0.151	(0.314)	0.023
Coal	-0.695***	(0.262)	0.555**	(0.226)	0.026	-0.365	(0.264)	0.076	(0.320)	0.012
Petroleum and Natural Gas	-0.127	(0.112)	0.038	(0.091)	0.003	-0.307	(0.251)	0.199	(0.224)	0.010
Utilities	-0.095	(0.100)	0.021	(0.090)	0.003	0.048	(0.141)	-0.152	(0.132)	0.010
Communication	0.055	(0.088)	0.006	(0.081)	0.001	0.208	(0.165)	-0.121	(0.164)	0.012
Personal and Business Services	0.067	(0.099)	-0.022	(0.097)	0.001	-0.124	(0.138)	0.201	(0.144)	0.005
Business Equipment	0.101	(0.113)	-0.095	(0.100)	0.001	-0.003	(0.151)	0.088	(0.127)	0.002
Business Supplies and Shipping Containers	0.073	(0.086)	-0.089	(0.071)	0.002	0.094	(0.142)	-0.123	(0.134)	0.003
Transportation	0.086	(0.087)	0.043	(0.075)	0.003	0.059	(0.173)	-0.023	(0.174)	0.001
Wholesale	0.028	(0.086)	0.028	(0.081)	0.001	-0.184	(0.130)	0.181	(0.149)	0.006
Retail	0.253***	(0.081)	0.004	(0.079)	0.013	0.033	(0.162)	0.150	(0.180)	0.009
Restaurants, Hotels, Motels	0.171*	(0.093)	-0.089	(0.082)	0.005	-0.023	(0.210)	0.089	(0.212)	0.001
Banking, Insurance, Real Estate, Trading	0.068	(0.079)	0.088	(0.073)	0.005	0.011	(0.118)	-0.010	(0.129)	0.000
Others	0.067	(0.084)	-0.035	(0.074)	0.001	-0.029	(0.131)	0.099	(0.117)	0.002

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 6: Linear Exposure to Japanese Yen and Euro (continued 1)

Industry	1986 to 1990					1991 to 1995				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	0.011	(0.203)	-0.102	(0.193)	0.002	-0.143	(0.155)	0.198	(0.133)	0.014
Beer & Liquor	-0.395	(0.280)	0.075	(0.198)	0.016	-0.199	(0.169)	0.189	(0.149)	0.018
Tobacco Products	0.137	(0.351)	-0.142	(0.264)	0.002	-0.110	(0.192)	0.367*	(0.219)	0.025
Recreation	0.568**	(0.281)	-0.266	(0.214)	0.016	0.158	(0.227)	-0.189	(0.193)	0.012
Printing and Publishing	0.158	(0.178)	0.008	(0.177)	0.004	0.128	(0.102)	0.218**	(0.094)	0.053
Consumer Goods	-0.064	(0.105)	0.135	(0.107)	0.003	0.097	(0.112)	-0.047	(0.094)	0.004
Apparel	0.281	(0.284)	0.291	(0.203)	0.034	0.016	(0.235)	0.133	(0.209)	0.005
Healthcare, Medical Equipment, Pharmaceutical Products	-0.176	(0.155)	0.111	(0.112)	0.002	-0.364**	(0.176)	0.341**	(0.143)	0.045
Chemicals	0.044	(0.198)	-0.172	(0.121)	0.005	0.092	(0.129)	-0.083	(0.098)	0.004
Textiles	0.283	(0.446)	0.142	(0.369)	0.017	0.384**	(0.177)	-0.105	(0.212)	0.036
Construction and Construction Materials	-0.126	(0.213)	0.122	(0.147)	0.001	0.012	(0.110)	-0.103	(0.118)	0.005
Steel Works Etc	-0.071	(0.321)	0.179	(0.320)	0.004	0.301*	(0.170)	-0.074	(0.182)	0.027
Fabricated Products and Machinery	-0.400*	(0.239)	0.347*	(0.191)	0.013	0.111	(0.144)	-0.338**	(0.149)	0.043
Electrical Equipment	-0.417**	(0.205)	0.285*	(0.145)	0.010	0.225	(0.149)	0.012	(0.131)	0.019
Automobiles and Trucks	0.148	(0.317)	-0.239	(0.265)	0.005	0.510**	(0.251)	-0.063	(0.189)	0.056
Aircraft, ships, and railroad equipment	0.165	(0.273)	0.189	(0.237)	0.018	0.075	(0.124)	-0.113	(0.123)	0.006
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.870*	(0.491)	0.450	(0.471)	0.031	0.014	(0.287)	-0.384	(0.307)	0.031
Coal	0.394	(0.380)	-0.134	(0.316)	0.011	0.118	(0.376)	-0.120	(0.280)	0.003
Petroleum and Natural Gas	-0.024	(0.259)	-0.006	(0.173)	0.000	-0.125	(0.161)	-0.187*	(0.102)	0.042
Utilities	0.107	(0.203)	-0.290	(0.198)	0.033	-0.091	(0.138)	0.010	(0.140)	0.006
Communication	0.561**	(0.252)	-0.233	(0.176)	0.035	0.036	(0.106)	0.088	(0.120)	0.009
Personal and Business Services	-0.063	(0.209)	0.050	(0.157)	0.000	0.008	(0.173)	-0.019	(0.128)	0.000
Business Equipment	0.125	(0.284)	-0.103	(0.222)	0.002	0.027	(0.153)	-0.253*	(0.150)	0.021
Business Supplies and Shipping Containers	-0.186	(0.219)	0.007	(0.113)	0.004	0.229*	(0.118)	-0.057	(0.112)	0.025
Transportation	0.315	(0.240)	0.060	(0.139)	0.019	0.277	(0.175)	-0.155	(0.122)	0.024
Wholesale	0.086	(0.156)	0.005	(0.104)	0.001	0.276***	(0.081)	-0.131	(0.087)	0.043
Retail	0.200	(0.208)	0.134	(0.133)	0.013	0.350**	(0.172)	-0.057	(0.196)	0.038
Restaurants, Hotels, Motels	0.316	(0.215)	0.022	(0.156)	0.015	0.348*	(0.189)	-0.147	(0.158)	0.036
Banking, Insurance, Real Estate, Trading	0.136	(0.225)	0.109	(0.214)	0.010	0.125	(0.090)	0.144	(0.096)	0.026
Others	-0.256	(0.157)	0.241*	(0.132)	0.006	0.080	(0.118)	-0.143	(0.138)	0.008

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 7: Linear Exposure to Japanese Yen and Euro (continued 2)

Industry	1996 to 2001					2002 to 2008				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.271	(0.301)	0.019	(0.184)	0.015	-0.109	(0.124)	-0.040	(0.121)	0.008
Beer & Liquor	-0.297	(0.421)	0.180	(0.333)	0.011	-0.131	(0.240)	-0.029	(0.222)	0.008
Tobacco Products	0.160	(0.557)	-0.082	(0.327)	0.001	-0.194	(0.454)	-0.487	(0.392)	0.035
Recreation	0.186	(0.307)	0.184	(0.211)	0.011	-0.320	(0.242)	0.265	(0.286)	0.009
Printing and Publishing	-0.060	(0.266)	0.058	(0.185)	0.001	-0.497***	(0.175)	0.608***	(0.191)	0.063
Consumer Goods	-0.147	(0.289)	-0.034	(0.305)	0.005	0.009	(0.177)	-0.001	(0.183)	0.000
Apparel	0.125	(0.387)	0.050	(0.255)	0.002	0.176	(0.258)	0.023	(0.258)	0.007
Healthcare, Medical Equipment, Pharmaceutical Products	-0.146	(0.304)	-0.162	(0.224)	0.015	-0.079	(0.120)	0.020	(0.125)	0.002
Chemicals	0.286	(0.291)	0.120	(0.175)	0.021	-0.317	(0.192)	0.360**	(0.163)	0.019
Textiles	0.058	(0.348)	0.425	(0.284)	0.039	-0.172	(0.408)	0.401	(0.369)	0.010
Construction and Construction Materials	-0.049	(0.298)	0.049	(0.218)	0.000	-0.243	(0.250)	0.234	(0.253)	0.009
Steel Works Etc	0.245	(0.389)	-0.162	(0.199)	0.004	-0.682**	(0.272)	0.141	(0.273)	0.024
Fabricated Products and Machinery	0.124	(0.313)	-0.095	(0.232)	0.002	-0.256	(0.200)	0.332	(0.206)	0.010
Electrical Equipment	-0.161	(0.240)	0.014	(0.193)	0.002	-0.112	(0.189)	-0.061	(0.191)	0.003
Automobiles and Trucks	0.117	(0.394)	0.047	(0.232)	0.001	-0.013	(0.342)	-0.110	(0.354)	0.001
Aircraft, ships, and railroad equipment	0.740**	(0.306)	-0.278	(0.244)	0.051	-0.294	(0.211)	0.013	(0.234)	0.014
Precious Metals, Non-Metallic, and Industrial Metal Mining	0.203	(0.497)	-0.629	(0.411)	0.044	-0.883**	(0.439)	0.829**	(0.405)	0.049
Coal	-1.082	(0.898)	0.781	(0.565)	0.040	-1.291**	(0.615)	1.080*	(0.646)	0.046
Petroleum and Natural Gas	0.260	(0.328)	-0.072	(0.215)	0.010	-0.154	(0.216)	0.209	(0.246)	0.005
Utilities	0.015	(0.356)	0.128	(0.229)	0.006	-0.039	(0.206)	0.011	(0.201)	0.000
Communication	-0.384	(0.284)	-0.012	(0.214)	0.019	0.268	(0.169)	-0.229	(0.182)	0.010
Personal and Business Services	0.139	(0.386)	-0.053	(0.316)	0.001	0.136	(0.111)	-0.085	(0.139)	0.003
Business Equipment	0.138	(0.424)	-0.086	(0.312)	0.001	0.233	(0.249)	-0.255	(0.246)	0.006
Business Supplies and Shipping Containers	0.101	(0.304)	-0.203	(0.186)	0.009	-0.011	(0.161)	0.066	(0.179)	0.001
Transportation	-0.034	(0.201)	0.206	(0.161)	0.010	-0.041	(0.161)	0.100	(0.202)	0.001
Wholesale	0.146	(0.323)	-0.141	(0.192)	0.007	-0.169	(0.151)	0.254	(0.177)	0.011
Retail	0.081	(0.262)	-0.079	(0.190)	0.001	0.384***	(0.138)	-0.077	(0.159)	0.033
Restaurants, Hotels, Motels	0.198	(0.251)	-0.226	(0.185)	0.015	0.144	(0.152)	-0.324*	(0.187)	0.016
Banking, Insurance, Real Estate, Trading	0.116	(0.279)	0.152	(0.165)	0.009	-0.074	(0.166)	0.027	(0.185)	0.001
Others	0.509*	(0.257)	0.025	(0.193)	0.031	-0.131	(0.202)	-0.172	(0.211)	0.017

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 8: Linear Exposure to Broad Currency Index

Industry	1974 to 2008			1974 to 1978			1979 to 1985			1986 to 1990		
	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.019	(0.118)	0.000	-0.138	(0.282)	0.000	0.051	(0.200)	0.001	-0.298	(0.339)	0.004
Beer & Liquor	-0.158	(0.158)	0.002	-0.452	(0.541)	0.004	-0.206	(0.250)	0.003	-0.538	(0.364)	0.012
Tobacco Products	0.060	(0.245)	0.000	0.295	(0.377)	0.003	0.664**	(0.313)	0.039	-0.215	(0.374)	0.002
Recreation	0.099	(0.176)	0.001	-0.174	(0.564)	0.000	0.330	(0.352)	0.006	0.280	(0.297)	0.003
Printing and Publishing	0.120	(0.142)	0.001	-0.474	(0.445)	0.005	0.145	(0.206)	0.001	0.233	(0.292)	0.002
Consumer Goods	0.113	(0.107)	0.001	-0.303	(0.265)	0.001	0.152	(0.180)	0.002	0.165	(0.171)	0.001
Apparel	0.224	(0.157)	0.002	0.516	(0.519)	0.003	-0.001	(0.239)	0.000	1.092***	(0.313)	0.033
Healthcare, Medical Equipment, Pharmaceutical Products	0.006	(0.105)	0.000	-0.805	(0.496)	0.011	0.066	(0.172)	0.001	-0.110	(0.200)	0.000
Chemicals	-0.230**	(0.116)	0.002	-0.184	(0.473)	0.001	-0.314*	(0.173)	0.007	-0.300	(0.243)	0.004
Textiles	0.029	(0.211)	0.000	0.389	(0.605)	0.003	-0.373	(0.267)	0.010	0.604	(0.444)	0.010
Construction and Construction Materials	-0.241*	(0.131)	0.002	-0.202	(0.404)	0.000	-0.290	(0.197)	0.005	0.004	(0.266)	0.000
Steel Works Etc	-0.522**	(0.207)	0.007	0.279	(0.483)	0.001	-0.538	(0.395)	0.012	0.149	(0.537)	0.001
Fabricated Products and Machinery	-0.406***	(0.140)	0.006	0.433*	(0.256)	0.004	-0.329	(0.199)	0.007	0.068	(0.362)	0.001
Electrical Equipment	-0.027	(0.118)	0.000	-0.140	(0.355)	0.000	0.027	(0.205)	0.000	-0.068	(0.303)	0.000
Automobiles and Trucks	0.083	(0.221)	0.000	0.448	(0.381)	0.006	0.454*	(0.269)	0.013	-0.241	(0.319)	0.002
Aircraft, ships, and railroad equipment	0.165	(0.146)	0.001	0.236	(0.566)	0.001	0.602**	(0.279)	0.014	0.791**	(0.359)	0.024
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.091***	(0.289)	0.030	0.375	(0.493)	0.003	-1.217**	(0.568)	0.036	-0.651	(0.781)	0.011
Coal	-0.931***	(0.309)	0.013	1.448*	(0.813)	0.017	-0.848**	(0.357)	0.023	0.497	(0.471)	0.009
Petroleum and Natural Gas	-0.274*	(0.160)	0.004	1.186***	(0.289)	0.041	-0.396	(0.319)	0.007	-0.136	(0.365)	0.001
Utilities	-0.138	(0.124)	0.002	0.423	(0.396)	0.006	-0.054	(0.190)	0.001	-0.299	(0.260)	0.010
Communication	0.193*	(0.114)	0.003	0.038	(0.353)	0.000	0.262	(0.242)	0.008	0.464*	(0.242)	0.013
Personal and Business Services	0.045	(0.121)	0.000	0.018	(0.483)	0.000	-0.085	(0.207)	0.001	-0.013	(0.297)	0.000
Business Equipment	-0.157	(0.144)	0.000	-0.162	(0.277)	0.000	0.085	(0.190)	0.000	-0.053	(0.307)	0.000
Business Supplies and Shipping Containers	-0.070	(0.119)	0.000	-0.004	(0.327)	0.000	-0.034	(0.207)	0.000	-0.320	(0.286)	0.004
Transportation	0.187	(0.127)	0.002	-0.207	(0.578)	0.001	-0.030	(0.266)	0.000	0.723**	(0.306)	0.021
Wholesale	-0.013	(0.119)	0.000	0.031	(0.496)	0.000	-0.025	(0.226)	0.001	0.115	(0.228)	0.001
Retail	0.470***	(0.127)	0.011	-0.308	(0.393)	0.002	0.384	(0.287)	0.010	0.586**	(0.263)	0.011
Restaurants, Hotels, Motels	0.142	(0.155)	0.001	-0.141	(0.717)	0.000	0.120	(0.314)	0.001	0.477	(0.302)	0.009
Banking, Insurance, Real Estate, Trading	0.182*	(0.103)	0.002	-0.265	(0.332)	0.002	-0.063	(0.168)	0.000	0.498**	(0.235)	0.012
Others	0.009	(0.118)	0.000	0.003	(0.409)	0.000	-0.024	(0.194)	0.000	0.104	(0.232)	0.001

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 9: Linear Exposure to Broad Currency Index (continued)

Industry	1991 to 1995			1996 to 2001			2002 to 2008		
	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2
Food Products	-0.071	(0.296)	0.000	-0.037	(0.553)	0.000	-0.297	(0.204)	0.011
Beer & Liquor	-0.415	(0.398)	0.015	-0.226	(0.780)	0.001	-0.407	(0.360)	0.016
Tobacco Products	0.600	(0.449)	0.016	0.425	(1.009)	0.002	-1.122	(0.799)	0.034
Recreation	0.353	(0.308)	0.009	0.131	(0.512)	0.000	-0.296	(0.351)	0.003
Printing and Publishing	0.531*	(0.277)	0.034	-0.196	(0.436)	0.001	-0.513	(0.349)	0.015
Consumer Goods	0.092	(0.188)	0.001	-0.328	(0.626)	0.004	-0.100	(0.289)	0.001
Apparel	0.061	(0.408)	0.000	-0.633	(0.612)	0.007	0.240	(0.394)	0.003
Healthcare, Medical Equipment, Pharmaceutical Products	-0.238	(0.282)	0.004	0.040	(0.423)	0.000	-0.094	(0.172)	0.001
Chemicals	0.081	(0.275)	0.001	-0.094	(0.478)	0.001	-0.422	(0.301)	0.009
Textiles	0.318	(0.470)	0.006	-0.193	(0.532)	0.001	-0.209	(0.658)	0.001
Construction and Construction Materials	-0.119	(0.194)	0.002	-0.351	(0.465)	0.003	-0.440	(0.430)	0.008
Steel Works Etc	0.604	(0.379)	0.028	-0.702	(0.600)	0.006	-0.984**	(0.462)	0.016
Fabricated Products and Machinery	-0.195	(0.276)	0.004	-1.264***	(0.460)	0.029	-0.335	(0.339)	0.004
Electrical Equipment	0.413	(0.296)	0.013	-0.014	(0.463)	0.000	-0.315	(0.293)	0.004
Automobiles and Trucks	0.854*	(0.468)	0.037	-0.106	(0.613)	0.000	-0.479	(0.579)	0.005
Aircraft, ships, and railroad equipment	-0.025	(0.266)	0.000	-0.044	(0.571)	0.000	-0.497	(0.358)	0.011
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.751	(0.514)	0.025	-1.558*	(0.886)	0.038	-1.273	(0.785)	0.031
Coal	-0.002	(0.575)	0.000	-2.378*	(1.347)	0.030	-1.865**	(0.911)	0.031
Petroleum and Natural Gas	-0.552**	(0.262)	0.036	-0.379	(0.595)	0.005	-0.321	(0.356)	0.004
Utilities	-0.323	(0.225)	0.018	0.253	(0.530)	0.003	-0.345	(0.325)	0.009
Communication	0.231	(0.169)	0.008	-0.035	(0.479)	0.000	0.476	(0.306)	0.010
Personal and Business Services	-0.064	(0.286)	0.000	0.180	(0.646)	0.000	0.268	(0.217)	0.004
Business Equipment	-0.498	(0.299)	0.018	-0.479	(0.706)	0.002	0.363	(0.398)	0.004
Business Supplies and Shipping Containers	0.387	(0.241)	0.019	-0.961*	(0.531)	0.029	-0.042	(0.246)	0.000
Transportation	0.421	(0.308)	0.015	0.017	(0.337)	0.000	0.035	(0.257)	0.000
Wholesale	0.296*	(0.164)	0.013	-0.648	(0.422)	0.016	-0.207	(0.272)	0.003
Retail	0.602	(0.400)	0.027	-0.016	(0.432)	0.000	0.671**	(0.260)	0.032
Restaurants, Hotels, Motels	0.578*	(0.334)	0.027	-0.428	(0.402)	0.006	-0.088	(0.297)	0.000
Banking, Insurance, Real Estate, Trading	0.547***	(0.171)	0.031	0.137	(0.419)	0.001	-0.137	(0.224)	0.001
Others	0.143	(0.232)	0.002	0.202	(0.507)	0.001	-0.623**	(0.312)	0.027

*** p<0.01, ** p<0.05, * p<0.1

$\Delta \bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 10: Linear Exposure to Major Currency Index

Industry	1974 to 2008			1974 to 1978			1979 to 1985			1986 to 1990		
	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.063	(0.099)	0.001	-0.150	(0.235)	0.001	0.000	(0.161)	0.000	-0.168	(0.241)	0.003
Beer & Liquor	-0.120	(0.127)	0.002	-0.178	(0.437)	0.001	-0.131	(0.195)	0.002	-0.370	(0.269)	0.011
Tobacco Products	0.006	(0.193)	0.000	0.131	(0.299)	0.001	0.523**	(0.238)	0.041	-0.026	(0.275)	0.000
Recreation	0.126	(0.128)	0.001	0.033	(0.495)	0.000	0.371	(0.265)	0.013	0.302	(0.225)	0.005
Printing and Publishing	0.127	(0.100)	0.002	-0.433	(0.376)	0.006	0.147	(0.170)	0.002	0.237	(0.212)	0.004
Consumer Goods	0.087	(0.088)	0.001	-0.169	(0.223)	0.000	0.095	(0.144)	0.001	0.130	(0.128)	0.001
Apparel	0.263**	(0.114)	0.004	0.319	(0.428)	0.002	0.050	(0.183)	0.000	0.778***	(0.241)	0.031
Healthcare, Medical Equipment, Pharmaceutical Products	-0.039	(0.082)	0.000	-0.533	(0.405)	0.007	0.082	(0.131)	0.002	-0.067	(0.148)	0.000
Chemicals	-0.094	(0.090)	0.000	-0.013	(0.383)	0.000	-0.237*	(0.140)	0.007	-0.241	(0.185)	0.005
Textiles	0.172	(0.163)	0.002	0.329	(0.487)	0.003	-0.241	(0.222)	0.007	0.477	(0.335)	0.011
Construction and Construction Materials	-0.131	(0.100)	0.001	-0.206	(0.335)	0.001	-0.179	(0.154)	0.003	-0.011	(0.197)	0.000
Steel Works Etc	-0.307*	(0.158)	0.004	0.306	(0.402)	0.003	-0.396	(0.307)	0.012	0.098	(0.396)	0.001
Fabricated Products and Machinery	-0.175*	(0.106)	0.002	0.457**	(0.204)	0.006	-0.186	(0.156)	0.004	-0.020	(0.258)	0.000
Electrical Equipment	-0.016	(0.089)	0.000	-0.175	(0.315)	0.001	0.038	(0.154)	0.000	-0.103	(0.233)	0.001
Automobiles and Trucks	0.077	(0.153)	0.000	0.280	(0.328)	0.003	0.225	(0.221)	0.005	-0.209	(0.228)	0.002
Aircraft, ships, and railroad equipment	0.174	(0.114)	0.002	0.212	(0.476)	0.001	0.395*	(0.224)	0.010	0.510**	(0.254)	0.018
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.727***	(0.229)	0.023	0.408	(0.417)	0.006	-0.897**	(0.431)	0.033	-0.470	(0.570)	0.010
Coal	-0.414*	(0.247)	0.005	1.028	(0.680)	0.013	-0.493*	(0.271)	0.013	0.312	(0.348)	0.007
Petroleum and Natural Gas	-0.127	(0.126)	0.002	0.908***	(0.240)	0.035	-0.202	(0.257)	0.003	-0.104	(0.260)	0.001
Utilities	-0.096	(0.094)	0.001	0.260	(0.336)	0.003	-0.121	(0.146)	0.004	-0.211	(0.196)	0.009
Communication	0.067	(0.091)	0.001	0.033	(0.295)	0.000	0.149	(0.193)	0.004	0.393**	(0.168)	0.018
Personal and Business Services	0.042	(0.097)	0.000	0.006	(0.410)	0.000	0.066	(0.162)	0.001	-0.014	(0.225)	0.000
Business Equipment	-0.037	(0.123)	0.000	-0.136	(0.244)	0.000	0.086	(0.153)	0.001	-0.066	(0.228)	0.001
Business Supplies and Shipping Containers	-0.032	(0.087)	0.000	0.001	(0.275)	0.000	-0.063	(0.160)	0.001	-0.238	(0.207)	0.004
Transportation	0.139	(0.097)	0.002	-0.124	(0.466)	0.000	0.016	(0.195)	0.000	0.495**	(0.219)	0.018
Wholesale	0.033	(0.090)	0.000	0.048	(0.405)	0.000	0.002	(0.171)	0.000	0.082	(0.166)	0.001
Retail	0.371***	(0.098)	0.012	-0.374	(0.334)	0.004	0.296	(0.224)	0.010	0.429**	(0.186)	0.011
Restaurants, Hotels, Motels	0.144	(0.117)	0.002	-0.028	(0.607)	0.000	0.074	(0.237)	0.000	0.418*	(0.222)	0.013
Banking, Insurance, Real Estate, Trading	0.173**	(0.079)	0.003	-0.162	(0.271)	0.001	-0.010	(0.140)	0.000	0.397**	(0.164)	0.014
Others	0.021	(0.092)	0.000	0.060	(0.340)	0.000	0.072	(0.143)	0.001	0.067	(0.175)	0.000

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 11: Linear Exposure to Major Currency Index (continued)

Industry	1991 to 1995			1996 to 2001			2002 to 2008		
	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2
Food Products	0.037	(0.228)	0.000	-0.157	(0.449)	0.002	-0.216	(0.132)	0.013
Beer & Liquor	-0.047	(0.238)	0.001	0.000	(0.701)	0.000	-0.264	(0.227)	0.015
Tobacco Products	0.255	(0.322)	0.005	0.450	(0.869)	0.005	-0.805	(0.539)	0.038
Recreation	0.176	(0.262)	0.004	0.242	(0.420)	0.002	-0.240	(0.238)	0.004
Printing and Publishing	0.521***	(0.172)	0.061	-0.042	(0.392)	0.000	-0.262	(0.216)	0.008
Consumer Goods	0.104	(0.139)	0.002	-0.094	(0.574)	0.001	-0.038	(0.180)	0.000
Apparel	0.267	(0.244)	0.007	0.049	(0.531)	0.000	0.158	(0.254)	0.003
Healthcare, Medical Equipment, Pharmaceutical Products	-0.099	(0.208)	0.002	-0.405	(0.394)	0.011	-0.022	(0.132)	0.000
Chemicals	0.004	(0.179)	0.000	0.551	(0.360)	0.018	-0.153	(0.216)	0.003
Textiles	0.568**	(0.266)	0.038	0.527	(0.520)	0.013	0.002	(0.439)	0.000
Construction and Construction Materials	-0.079	(0.159)	0.001	-0.022	(0.432)	0.000	-0.190	(0.266)	0.004
Steel Works Etc	0.390	(0.237)	0.022	-0.214	(0.490)	0.001	-0.674**	(0.304)	0.016
Fabricated Products and Machinery	-0.215	(0.206)	0.008	-0.331	(0.412)	0.003	-0.103	(0.213)	0.001
Electrical Equipment	0.376*	(0.210)	0.020	-0.073	(0.402)	0.000	-0.221	(0.188)	0.004
Automobiles and Trucks	0.696*	(0.359)	0.046	0.089	(0.556)	0.000	-0.236	(0.333)	0.003
Aircraft, ships, and railroad equipment	-0.031	(0.209)	0.000	0.655	(0.501)	0.015	-0.348	(0.222)	0.012
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.620	(0.382)	0.031	-0.915	(1.057)	0.023	-0.621	(0.489)	0.016
Coal	0.062	(0.470)	0.000	-0.967	(1.172)	0.009	-1.067*	(0.591)	0.022
Petroleum and Natural Gas	-0.500***	(0.174)	0.055	0.190	(0.556)	0.002	-0.116	(0.257)	0.001
Utilities	-0.153	(0.168)	0.007	0.186	(0.428)	0.003	-0.141	(0.216)	0.003
Communication	0.141	(0.134)	0.006	-0.659*	(0.391)	0.020	0.237	(0.191)	0.005
Personal and Business Services	0.044	(0.210)	0.000	-0.055	(0.548)	0.000	0.121	(0.137)	0.002
Business Equipment	-0.242	(0.213)	0.008	-0.129	(0.651)	0.000	0.156	(0.255)	0.002
Business Supplies and Shipping Containers	0.258	(0.161)	0.015	-0.190	(0.415)	0.002	-0.046	(0.165)	0.000
Transportation	0.249	(0.251)	0.010	0.218	(0.311)	0.003	-0.013	(0.176)	0.000
Wholesale	0.292**	(0.113)	0.024	-0.244	(0.418)	0.004	-0.052	(0.175)	0.001
Retail	0.532*	(0.269)	0.040	0.146	(0.411)	0.001	0.447**	(0.173)	0.031
Restaurants, Hotels, Motels	0.412	(0.255)	0.025	0.003	(0.384)	0.000	-0.077	(0.196)	0.000
Banking, Insurance, Real Estate, Trading	0.395***	(0.121)	0.030	0.360	(0.354)	0.007	-0.104	(0.131)	0.001
Others	0.016	(0.179)	0.000	0.572	(0.408)	0.013	-0.386*	(0.216)	0.022

*** p<0.01, ** p<0.05, * p<0.1

$\Delta \bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 12: Orthogonalized Linear Exposure to Japanese Yen and Euro

Industry	1979 to 2008					1979 to 1985				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	ΔR^2	Coef.	s.e.	Coef.	s.e.	ΔR^2
Food Products	-0.224***	(0.087)	0.076	(0.075)	0.009	0.037	(0.151)	-0.096	(0.148)	-0.010
Beer & Liquor	-0.337***	(0.118)	0.160	(0.111)	0.015	-0.449**	(0.192)	0.322*	(0.189)	0.020
Tobacco Products	-0.185	(0.170)	0.074	(0.126)	-0.001	0.136	(0.214)	0.126	(0.177)	0.003
Recreation	-0.206*	(0.114)	0.247**	(0.103)	0.006	-0.329*	(0.197)	0.473*	(0.238)	0.018
Printing and Publishing	-0.212**	(0.095)	0.285***	(0.087)	0.014	-0.184	(0.139)	0.184	(0.151)	-0.002
Consumer Goods	-0.058	(0.088)	0.043	(0.101)	-0.002	0.128	(0.149)	-0.062	(0.127)	-0.004
Apparel	-0.136	(0.120)	0.264**	(0.107)	0.007	-0.444***	(0.167)	0.361**	(0.179)	0.019
Healthcare, Medical Equipment, Pharmaceutical Products	-0.271***	(0.093)	0.124	(0.081)	0.013	-0.268*	(0.150)	0.199	(0.139)	0.006
Chemicals	-0.234**	(0.091)	0.112	(0.077)	0.007	-0.300**	(0.114)	0.010	(0.111)	0.016
Textiles	-0.212	(0.139)	0.367***	(0.128)	0.014	-0.320*	(0.180)	0.117	(0.157)	0.006
Construction and Construction Materials	-0.311***	(0.103)	0.164*	(0.090)	0.012	-0.183	(0.142)	-0.023	(0.133)	0.003
Steel Works Etc	-0.377***	(0.145)	0.099	(0.119)	0.009	-0.232	(0.242)	-0.162	(0.253)	0.010
Fabricated Products and Machinery	-0.253**	(0.099)	0.057	(0.093)	0.007	-0.017	(0.108)	-0.234*	(0.123)	0.011
Electrical Equipment	-0.249***	(0.086)	0.134*	(0.078)	0.006	-0.150	(0.171)	0.094	(0.133)	-0.005
Automobiles and Trucks	-0.012	(0.157)	0.063	(0.132)	-0.002	0.237	(0.250)	-0.072	(0.221)	-0.003
Aircraft, ships, and railroad equipment	-0.047	(0.106)	0.109	(0.096)	-0.001	-0.267	(0.204)	0.443**	(0.188)	0.010
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.557***	(0.191)	-0.022	(0.186)	0.026	-0.717*	(0.367)	-0.164	(0.348)	0.048
Coal	-0.824***	(0.265)	0.490**	(0.224)	0.026	-0.565*	(0.295)	0.011	(0.309)	0.025
Petroleum and Natural Gas	-0.231**	(0.115)	0.038	(0.095)	0.006	-0.506*	(0.268)	0.143	(0.227)	0.015
Utilities	-0.188*	(0.102)	0.047	(0.092)	0.007	-0.071	(0.151)	-0.096	(0.140)	0.000
Communication	-0.109	(0.090)	0.082	(0.085)	0.000	0.054	(0.169)	-0.005	(0.171)	-0.018
Personal and Business Services	-0.190*	(0.102)	0.090	(0.102)	0.002	-0.451***	(0.140)	0.359**	(0.139)	0.015
Business Equipment	-0.117	(0.120)	0.006	(0.104)	0.000	-0.217	(0.132)	0.234**	(0.115)	0.003
Business Supplies and Shipping Containers	-0.085	(0.092)	0.002	(0.071)	-0.001	-0.059	(0.151)	-0.027	(0.141)	-0.004
Transportation	-0.087	(0.085)	0.142*	(0.075)	0.001	-0.118	(0.157)	0.054	(0.179)	-0.006
Wholesale	-0.170*	(0.089)	0.126	(0.081)	0.004	-0.531***	(0.141)	0.357**	(0.157)	0.025
Retail	0.035	(0.081)	0.130	(0.083)	0.003	-0.249	(0.159)	0.381**	(0.184)	0.015
Restaurants, Hotels, Motels	-0.013	(0.094)	0.031	(0.084)	-0.003	-0.198	(0.212)	0.216	(0.215)	-0.004
Banking, Insurance, Real Estate, Trading	-0.097	(0.081)	0.166**	(0.075)	0.004	-0.180	(0.121)	0.080	(0.134)	-0.001
Others	-0.113	(0.088)	0.043	(0.080)	-0.001	-0.225*	(0.126)	0.176	(0.124)	0.001

*** p<0.01, ** p<0.05, * p<0.1

$\Delta \bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 13: Orthogonalized Linear Exposure to Japanese Yen and Euro (continued 1)

Industry	1986 to 1990					1991 to 1995				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.073	(0.211)	-0.095	(0.228)	-0.005	-0.348**	(0.161)	0.193	(0.136)	0.024
Beer & Liquor	-0.489	(0.301)	0.055	(0.198)	0.017	-0.368**	(0.172)	0.274*	(0.154)	0.031
Tobacco Products	0.118	(0.339)	-0.181	(0.268)	-0.012	-0.323	(0.199)	0.449**	(0.223)	0.017
Recreation	0.368	(0.320)	-0.205	(0.225)	-0.002	-0.069	(0.232)	-0.048	(0.205)	-0.021
Printing and Publishing	-0.115	(0.166)	0.201	(0.167)	-0.001	-0.066	(0.105)	0.319***	(0.099)	0.039
Consumer Goods	-0.248**	(0.112)	0.226*	(0.113)	0.003	-0.040	(0.111)	0.065	(0.110)	-0.015
Apparel	0.042	(0.275)	0.456**	(0.201)	0.027	-0.290	(0.246)	0.214	(0.238)	-0.001
Healthcare, Medical Equipment, Pharmaceutical Products	-0.202	(0.155)	0.083	(0.118)	-0.003	-0.550***	(0.188)	0.320**	(0.138)	0.064
Chemicals	-0.177	(0.174)	-0.023	(0.103)	0.000	-0.099	(0.129)	0.008	(0.121)	-0.011
Textiles	0.030	(0.410)	0.417	(0.351)	0.013	0.055	(0.177)	0.067	(0.203)	-0.019
Construction and Construction Materials	-0.358*	(0.207)	0.287**	(0.141)	0.003	-0.231*	(0.129)	-0.013	(0.123)	0.012
Steel Works Etc	-0.464	(0.344)	0.460	(0.383)	-0.001	0.057	(0.183)	0.020	(0.180)	-0.021
Fabricated Products and Machinery	-0.722***	(0.245)	0.588***	(0.204)	0.028	-0.049	(0.136)	-0.257	(0.160)	0.017
Electrical Equipment	-0.590***	(0.218)	0.332**	(0.143)	0.012	-0.008	(0.174)	0.077	(0.136)	-0.014
Automobiles and Trucks	-0.243	(0.320)	0.026	(0.274)	-0.003	0.298	(0.274)	0.105	(0.220)	0.001
Aircraft, ships, and railroad equipment	-0.087	(0.303)	0.312	(0.255)	0.005	-0.055	(0.133)	-0.176	(0.125)	0.004
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.022*	(0.536)	0.615	(0.543)	0.008	-0.020	(0.311)	-0.554*	(0.313)	0.028
Coal	0.247	(0.409)	-0.160	(0.347)	-0.014	-0.043	(0.392)	-0.296	(0.300)	-0.012
Petroleum and Natural Gas	-0.131	(0.275)	0.000	(0.190)	-0.016	-0.228	(0.199)	-0.151	(0.128)	0.034
Utilities	0.081	(0.236)	-0.321	(0.206)	0.025	-0.157	(0.149)	0.060	(0.161)	-0.015
Communication	0.454*	(0.250)	-0.220	(0.200)	0.012	-0.078	(0.115)	0.128	(0.117)	-0.009
Personal and Business Services	-0.377*	(0.206)	0.196	(0.155)	0.002	-0.213	(0.175)	0.033	(0.147)	-0.002
Business Equipment	-0.139	(0.271)	0.034	(0.234)	-0.009	-0.104	(0.162)	-0.163	(0.178)	-0.005
Business Supplies and Shipping Containers	-0.444**	(0.197)	0.165	(0.107)	0.009	0.046	(0.123)	-0.021	(0.112)	-0.020
Transportation	0.016	(0.236)	0.227	(0.161)	0.001	0.071	(0.187)	-0.027	(0.134)	-0.012
Wholesale	-0.145	(0.169)	0.138	(0.113)	-0.002	0.090	(0.087)	-0.044	(0.082)	-0.004
Retail	-0.034	(0.240)	0.249	(0.150)	0.004	0.068	(0.156)	0.057	(0.196)	-0.014
Restaurants, Hotels, Motels	0.169	(0.240)	0.087	(0.165)	0.003	0.120	(0.179)	-0.054	(0.164)	-0.015
Banking, Insurance, Real Estate, Trading	-0.090	(0.208)	0.249	(0.200)	0.004	-0.131	(0.100)	0.212**	(0.102)	0.009
Others	-0.498***	(0.152)	0.355**	(0.138)	0.011	-0.172	(0.132)	-0.084	(0.139)	0.008

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 14: Orthogonalized Linear Exposure to Japanese Yen and Euro (continued 2)

Industry	1996 to 2001					2002 to 2008				
	€		¥			€		¥		
	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.339	(0.307)	0.077	(0.198)	-0.003	-0.121	(0.114)	-0.101	(0.136)	0.007
Beer & Liquor	-0.402	(0.439)	0.208	(0.355)	-0.008	-0.194	(0.245)	-0.005	(0.225)	-0.006
Tobacco Products	0.189	(0.492)	-0.069	(0.311)	-0.027	-0.322	(0.539)	-0.499	(0.459)	0.026
Recreation	-0.015	(0.317)	0.274	(0.228)	-0.003	-0.581**	(0.238)	0.355	(0.285)	0.020
Printing and Publishing	-0.176	(0.274)	0.114	(0.195)	-0.009	-0.655***	(0.163)	0.674***	(0.203)	0.077
Consumer Goods	-0.183	(0.246)	-0.081	(0.283)	-0.011	-0.050	(0.165)	0.008	(0.194)	-0.016
Apparel	-0.077	(0.380)	0.177	(0.241)	-0.014	0.001	(0.249)	0.092	(0.262)	-0.009
Healthcare, Medical Equipment, Pharmaceutical Products	-0.204	(0.318)	-0.130	(0.233)	-0.004	-0.209	(0.134)	0.122	(0.123)	0.003
Chemicals	0.148	(0.310)	0.170	(0.198)	-0.005	-0.395**	(0.186)	0.283*	(0.153)	0.013
Textiles	-0.023	(0.383)	0.390	(0.305)	0.009	-0.335	(0.378)	0.457	(0.325)	-0.002
Construction and Construction Materials	-0.186	(0.272)	0.102	(0.200)	-0.008	-0.476*	(0.244)	0.405	(0.260)	0.018
Steel Works Etc	0.014	(0.411)	-0.059	(0.219)	-0.014	-1.029***	(0.284)	0.342	(0.281)	0.046
Fabricated Products and Machinery	-0.098	(0.334)	0.003	(0.246)	-0.012	-0.404*	(0.204)	0.371*	(0.211)	0.008
Electrical Equipment	-0.344	(0.234)	0.096	(0.199)	0.002	-0.390**	(0.190)	0.134	(0.201)	0.011
Automobiles and Trucks	-0.019	(0.391)	0.045	(0.249)	-0.016	-0.306	(0.318)	0.011	(0.380)	-0.003
Aircraft, ships, and railroad equipment	0.615**	(0.299)	-0.272	(0.240)	0.021	-0.554**	(0.211)	0.170	(0.239)	0.030
Precious Metals, Non-Metallic, and Industrial Metal Mining	0.026	(0.519)	-0.496	(0.436)	0.004	-1.200**	(0.457)	1.096**	(0.438)	0.067
Coal	-1.236	(0.810)	0.990*	(0.548)	0.029	-1.021*	(0.589)	0.591	(0.662)	0.010
Petroleum and Natural Gas	0.133	(0.351)	0.015	(0.245)	-0.022	-0.169	(0.212)	0.106	(0.260)	-0.015
Utilities	0.044	(0.342)	0.134	(0.228)	-0.021	-0.104	(0.198)	-0.039	(0.204)	-0.010
Communication	-0.559**	(0.278)	0.081	(0.212)	0.025	-0.081	(0.142)	0.032	(0.184)	-0.005
Personal and Business Services	-0.115	(0.422)	0.091	(0.346)	-0.010	-0.128	(0.110)	0.071	(0.154)	-0.003
Business Equipment	-0.112	(0.453)	-0.051	(0.337)	-0.013	-0.052	(0.261)	-0.068	(0.248)	-0.006
Business Supplies and Shipping Containers	-0.024	(0.290)	-0.200	(0.189)	-0.008	-0.141	(0.154)	0.098	(0.165)	-0.006
Transportation	-0.195	(0.196)	0.259	(0.162)	0.001	-0.147	(0.167)	0.133	(0.229)	-0.009
Wholesale	0.057	(0.304)	-0.111	(0.196)	-0.016	-0.303*	(0.165)	0.290	(0.180)	0.010
Retail	-0.064	(0.284)	-0.010	(0.196)	-0.014	0.227	(0.148)	0.014	(0.174)	0.006
Restaurants, Hotels, Motels	0.088	(0.257)	-0.165	(0.185)	-0.013	-0.147	(0.167)	-0.082	(0.200)	-0.001
Banking, Insurance, Real Estate, Trading	-0.061	(0.286)	0.238	(0.174)	-0.001	-0.210	(0.144)	0.057	(0.170)	0.001
Others	0.383	(0.258)	0.093	(0.207)	0.004	-0.175	(0.178)	-0.296	(0.204)	0.030

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 15: Orthogonalized Linear Exposure to Broad Currency Index

Industry	1974 to 2008			1974 to 1978			1979 to 1985			1986 to 1990		
	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.453***	(0.120)	0.014	-0.718**	(0.336)	0.009	-0.256	(0.215)	0.002	-0.798*	(0.405)	0.024
Beer & Liquor	-0.597***	(0.166)	0.016	-1.173*	(0.674)	0.016	-0.538*	(0.287)	0.016	-1.148***	(0.394)	0.045
Tobacco Products	-0.358	(0.264)	0.003	0.266	(0.450)	-0.005	0.316	(0.298)	0.001	-0.733	(0.438)	0.011
Recreation	-0.521***	(0.171)	0.008	-0.939	(0.766)	0.004	-0.205	(0.378)	-0.004	-0.412	(0.311)	0.001
Printing and Publishing	-0.419***	(0.144)	0.009	-1.143**	(0.510)	0.021	-0.411*	(0.216)	0.008	-0.208	(0.273)	-0.001
Consumer Goods	-0.352***	(0.118)	0.007	-0.844**	(0.316)	0.011	-0.179	(0.196)	0.000	-0.333*	(0.177)	0.004
Apparel	-0.410**	(0.166)	0.005	-0.608	(0.772)	-0.004	-0.542*	(0.274)	0.014	0.608**	(0.300)	0.006
Healthcare, Medical Equipment, Pharmaceutical Products	-0.477***	(0.113)	0.012	-0.844	(0.632)	0.005	-0.407*	(0.207)	0.012	-0.630***	(0.204)	0.016
Chemicals	-0.735***	(0.120)	0.026	-0.684	(0.468)	0.005	-0.928***	(0.182)	0.057	-0.757***	(0.246)	0.019
Textiles	-0.471**	(0.206)	0.007	-0.313	(0.727)	-0.005	-0.803***	(0.302)	0.041	0.433	(0.420)	-0.002
Construction and Construction Materials	-0.852***	(0.136)	0.031	-0.973*	(0.516)	0.012	-0.906***	(0.192)	0.042	-0.452*	(0.261)	0.004
Steel Works Etc	-1.139***	(0.217)	0.034	-0.328	(0.571)	-0.007	-1.249***	(0.381)	0.060	-0.245	(0.574)	-0.007
Fabricated Products and Machinery	-0.966***	(0.136)	0.036	-0.087	(0.295)	-0.003	-0.951***	(0.193)	0.052	-0.320	(0.359)	-0.001
Electrical Equipment	-0.658***	(0.122)	0.016	-0.658	(0.394)	0.004	-0.567**	(0.216)	0.013	-0.742**	(0.329)	0.015
Automobiles and Trucks	-0.450**	(0.222)	0.006	-0.477	(0.575)	-0.002	0.003	(0.248)	-0.006	-0.709**	(0.294)	0.011
Aircraft, ships, and railroad equipment	-0.361**	(0.153)	0.004	-0.303	(0.630)	-0.004	-0.002	(0.299)	-0.004	0.265	(0.374)	-0.002
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.586***	(0.296)	0.060	0.108	(0.569)	-0.007	-2.117***	(0.602)	0.099	-0.812	(0.864)	-0.001
Coal	-1.457***	(0.310)	0.030	0.980	(0.866)	-0.004	-1.616***	(0.391)	0.078	-0.166	(0.463)	-0.008
Petroleum and Natural Gas	-0.648***	(0.161)	0.020	0.981***	(0.350)	0.021	-1.072***	(0.355)	0.043	-0.606	(0.374)	0.012
Utilities	-0.446***	(0.128)	0.017	-0.104	(0.508)	-0.008	-0.389**	(0.184)	0.015	-0.602**	(0.254)	0.028
Communication	-0.248**	(0.116)	0.003	-0.428	(0.365)	0.004	-0.068	(0.267)	-0.009	0.038	(0.252)	-0.005
Personal and Business Services	-0.668***	(0.125)	0.015	-0.542	(0.527)	0.000	-0.801***	(0.227)	0.027	-0.669**	(0.298)	0.012
Business Equipment	-0.816***	(0.157)	0.018	-0.819**	(0.365)	0.010	-0.479**	(0.186)	0.011	-0.585*	(0.302)	0.008
Business Supplies and Shipping Containers	-0.563***	(0.123)	0.017	-0.434	(0.318)	0.001	-0.516**	(0.207)	0.017	-0.822***	(0.302)	0.023
Transportation	-0.307**	(0.122)	0.004	-0.578	(0.553)	0.002	-0.622**	(0.286)	0.016	0.243	(0.329)	-0.003
Wholesale	-0.562***	(0.119)	0.017	-0.459	(0.575)	0.001	-0.789***	(0.237)	0.030	-0.371*	(0.209)	0.004
Retail	-0.146	(0.128)	0.000	-1.358**	(0.528)	0.027	-0.093	(0.286)	-0.004	-0.001	(0.297)	-0.003
Restaurants, Hotels, Motels	-0.450***	(0.149)	0.008	-1.075	(0.853)	0.006	-0.299	(0.316)	0.000	-0.035	(0.287)	-0.004
Banking, Insurance, Real Estate, Trading	-0.317***	(0.103)	0.005	-0.709**	(0.343)	0.007	-0.581***	(0.180)	0.026	0.079	(0.220)	-0.003
Others	-0.513***	(0.120)	0.012	-0.349	(0.429)	0.000	-0.596***	(0.183)	0.018	-0.494*	(0.262)	0.006

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 16: Orthogonalized Linear Exposure to Broad Currency Index (continued)

Industry	1991 to 1995			1996 to 2001			2002 to 2008		
	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2
Food Products	-0.783***	(0.292)	0.042	-0.142	(0.606)	-0.012	-0.490***	(0.182)	0.027
Beer & Liquor	-0.879**	(0.379)	0.054	-0.474	(0.825)	-0.008	-0.667*	(0.369)	0.035
Tobacco Products	-0.114	(0.455)	-0.011	-0.015	(1.057)	-0.015	-1.585*	(0.911)	0.058
Recreation	-0.179	(0.348)	-0.010	-0.226	(0.542)	-0.006	-1.055***	(0.355)	0.030
Printing and Publishing	-0.015	(0.294)	-0.007	-0.632	(0.451)	0.008	-0.938***	(0.306)	0.049
Consumer Goods	-0.341	(0.221)	0.004	-0.799	(0.652)	0.013	-0.308	(0.264)	0.004
Apparel	-0.598	(0.444)	0.008	-0.873	(0.619)	0.006	-0.296	(0.385)	-0.001
Healthcare, Medical Equipment, Pharmaceutical Products	-0.842**	(0.335)	0.037	-0.375	(0.424)	-0.005	-0.454**	(0.194)	0.020
Chemicals	-0.443	(0.309)	0.012	-0.414	(0.472)	-0.003	-0.788**	(0.312)	0.027
Textiles	-0.322	(0.464)	-0.004	-0.509	(0.506)	-0.005	-0.737	(0.616)	0.007
Construction and Construction Materials	-0.800***	(0.249)	0.049	-0.766	(0.460)	0.011	-1.092**	(0.414)	0.046
Steel Works Etc	-0.046	(0.433)	-0.011	-1.424***	(0.527)	0.018	-2.027***	(0.496)	0.069
Fabricated Products and Machinery	-0.701**	(0.281)	0.034	-1.690***	(0.470)	0.049	-0.949***	(0.340)	0.026
Electrical Equipment	-0.227	(0.328)	-0.004	-0.661	(0.491)	0.004	-1.084***	(0.300)	0.048
Automobiles and Trucks	0.385	(0.564)	-0.007	-0.916	(0.568)	0.009	-1.307**	(0.532)	0.035
Aircraft, ships, and railroad equipment	-0.507*	(0.283)	0.018	-0.555	(0.553)	-0.003	-1.129***	(0.336)	0.053
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.983	(0.595)	0.021	-1.560	(1.015)	0.028	-2.010**	(0.794)	0.070
Coal	-0.665	(0.592)	0.002	-2.591*	(1.465)	0.022	-1.963**	(0.924)	0.027
Petroleum and Natural Gas	-0.923**	(0.353)	0.086	-0.459	(0.656)	-0.005	-0.593*	(0.338)	0.006
Utilities	-0.535**	(0.258)	0.034	-0.061	(0.488)	-0.015	-0.688**	(0.300)	0.030
Communication	-0.220	(0.199)	-0.002	-0.436	(0.505)	-0.003	-0.393*	(0.235)	0.005
Personal and Business Services	-0.657**	(0.315)	0.026	-0.469	(0.673)	-0.003	-0.483**	(0.202)	0.009
Business Equipment	-0.943**	(0.355)	0.051	-1.508**	(0.726)	0.012	-0.549	(0.411)	0.004
Business Supplies and Shipping Containers	-0.138	(0.267)	-0.007	-1.272**	(0.488)	0.045	-0.420*	(0.247)	0.009
Transportation	-0.084	(0.362)	-0.006	-0.351	(0.322)	-0.003	-0.313	(0.264)	0.001
Wholesale	-0.207	(0.176)	0.001	-1.174**	(0.452)	0.043	-0.681**	(0.282)	0.026
Retail	-0.031	(0.321)	-0.009	-0.430	(0.452)	-0.001	0.159	(0.261)	-0.003
Restaurants, Hotels, Motels	0.017	(0.312)	-0.010	-0.655	(0.434)	0.006	-0.780***	(0.266)	0.034
Banking, Insurance, Real Estate, Trading	-0.159	(0.196)	-0.002	-0.306	(0.445)	-0.004	-0.568***	(0.200)	0.017
Others	-0.528*	(0.293)	0.019	-0.272	(0.520)	-0.008	-0.856***	(0.294)	0.047

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 17: Orthogonalized Linear Exposure to Major Currency Index

Industry	1974 to 2008			1974 to 1978			1979 to 1985			1986 to 1990		
	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$	Coef.	s.e.	$\Delta\bar{R}^2$
Food Products	-0.341***	(0.098)	0.014	-0.544**	(0.271)	0.007	-0.154	(0.167)	-0.002	-0.476*	(0.281)	0.015
Beer & Liquor	-0.401***	(0.131)	0.013	-0.630	(0.527)	0.004	-0.349	(0.219)	0.010	-0.745**	(0.283)	0.035
Tobacco Products	-0.292	(0.199)	0.003	0.109	(0.343)	-0.006	0.278	(0.230)	0.004	-0.341	(0.305)	0.000
Recreation	-0.290**	(0.128)	0.004	-0.457	(0.644)	-0.003	-0.024	(0.286)	-0.006	-0.165	(0.246)	-0.003
Printing and Publishing	-0.218**	(0.103)	0.004	-0.881**	(0.429)	0.018	-0.183	(0.172)	0.000	-0.080	(0.193)	-0.003
Consumer Goods	-0.208**	(0.094)	0.004	-0.519*	(0.262)	0.005	-0.092	(0.152)	-0.003	-0.207	(0.128)	0.003
Apparel	-0.139	(0.120)	0.000	-0.478	(0.619)	-0.004	-0.311	(0.214)	0.006	0.431*	(0.226)	0.006
Healthcare, Medical Equipment, Pharmaceutical Products	-0.379***	(0.087)	0.014	-0.511	(0.492)	0.000	-0.236	(0.156)	0.005	-0.381**	(0.148)	0.010
Chemicals	-0.431***	(0.095)	0.015	-0.332	(0.381)	-0.001	-0.674***	(0.147)	0.052	-0.562***	(0.177)	0.020
Textiles	-0.136	(0.161)	-0.001	-0.150	(0.574)	-0.007	-0.507**	(0.239)	0.027	0.338	(0.308)	-0.001
Construction and Construction Materials	-0.521***	(0.104)	0.020	-0.729*	(0.420)	0.010	-0.600***	(0.143)	0.032	-0.326*	(0.186)	0.004
Steel Works Etc	-0.729***	(0.161)	0.024	-0.096	(0.465)	-0.009	-0.933***	(0.296)	0.058	-0.216	(0.409)	-0.006
Fabricated Products and Machinery	-0.549***	(0.104)	0.020	0.115	(0.222)	-0.002	-0.637***	(0.150)	0.041	-0.307	(0.249)	0.001
Electrical Equipment	-0.431***	(0.091)	0.012	-0.514	(0.344)	0.004	-0.362**	(0.164)	0.009	-0.539**	(0.247)	0.014
Automobiles and Trucks	-0.264*	(0.156)	0.003	-0.387	(0.471)	-0.002	-0.040	(0.188)	-0.006	-0.578***	(0.204)	0.016
Aircraft, ships, and railroad equipment	-0.173	(0.119)	0.001	-0.143	(0.521)	-0.005	-0.018	(0.248)	-0.004	0.130	(0.268)	-0.003
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.052***	(0.239)	0.047	0.264	(0.478)	-0.005	-1.621***	(0.470)	0.101	-0.582	(0.617)	-0.002
Coal	-0.811***	(0.248)	0.016	0.671	(0.702)	-0.006	-1.100***	(0.292)	0.062	-0.141	(0.340)	-0.008
Petroleum and Natural Gas	-0.384***	(0.128)	0.012	0.764***	(0.284)	0.019	-0.743***	(0.272)	0.035	-0.419	(0.261)	0.010
Utilities	-0.297***	(0.095)	0.013	-0.113	(0.410)	-0.008	-0.342**	(0.139)	0.022	-0.403**	(0.192)	0.022
Communication	-0.229**	(0.091)	0.005	-0.298	(0.302)	0.000	-0.033	(0.210)	-0.009	0.111	(0.178)	-0.004
Personal and Business Services	-0.426***	(0.100)	0.010	-0.359	(0.439)	-0.002	-0.437**	(0.174)	0.012	-0.480**	(0.223)	0.012
Business Equipment	-0.471***	(0.131)	0.010	-0.578*	(0.309)	0.007	-0.264*	(0.140)	0.004	-0.457**	(0.218)	0.010
Business Supplies and Shipping Containers	-0.348***	(0.090)	0.012	-0.281	(0.267)	0.000	-0.367**	(0.157)	0.015	-0.590***	(0.209)	0.022
Transportation	-0.181*	(0.095)	0.002	-0.349	(0.442)	-0.001	-0.389*	(0.214)	0.009	0.130	(0.233)	-0.004
Wholesale	-0.320***	(0.093)	0.009	-0.271	(0.458)	-0.002	-0.493***	(0.181)	0.019	-0.259*	(0.150)	0.004
Retail	-0.022	(0.096)	-0.001	-1.124**	(0.425)	0.028	0.019	(0.222)	-0.005	0.020	(0.208)	-0.003
Restaurants, Hotels, Motels	-0.228**	(0.113)	0.003	-0.658	(0.706)	0.001	-0.197	(0.233)	-0.002	0.082	(0.217)	-0.003
Banking, Insurance, Real Estate, Trading	-0.157**	(0.080)	0.002	-0.435	(0.270)	0.003	-0.356**	(0.145)	0.016	0.102	(0.160)	-0.002
Others	-0.324***	(0.092)	0.009	-0.147	(0.347)	-0.002	-0.337**	(0.134)	0.009	-0.337*	(0.191)	0.005

*** p<0.01, ** p<0.05, * p<0.1

$\Delta\bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

Table 18: Orthogonalized Linear Exposure to Major Currency Index (continued)

Industry	1991 to 1995			1996 to 2001			2002 to 2008		
	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2	Coef.	s.e.	ΔR^2
Food Products	-0.464*	(0.237)	0.024	-0.235	(0.467)	-0.009	-0.357***	(0.122)	0.033
Beer & Liquor	-0.357	(0.231)	0.010	-0.202	(0.715)	-0.012	-0.425*	(0.233)	0.030
Tobacco Products	-0.226	(0.328)	-0.008	0.363	(0.814)	-0.011	-1.090*	(0.590)	0.061
Recreation	-0.167	(0.284)	-0.008	-0.083	(0.425)	-0.007	-0.746***	(0.247)	0.033
Printing and Publishing	0.169	(0.187)	0.000	-0.300	(0.395)	-0.001	-0.536***	(0.198)	0.034
Consumer Goods	-0.150	(0.161)	-0.004	-0.355	(0.585)	-0.002	-0.178	(0.171)	0.000
Apparel	-0.231	(0.321)	-0.005	-0.181	(0.520)	-0.008	-0.190	(0.250)	-0.001
Healthcare, Medical Equipment, Pharmaceutical Products	-0.562**	(0.245)	0.029	-0.599	(0.383)	0.017	-0.259*	(0.141)	0.012
Chemicals	-0.359*	(0.198)	0.017	0.297	(0.362)	-0.004	-0.428**	(0.211)	0.016
Textiles	0.129	(0.279)	-0.008	0.265	(0.496)	-0.008	-0.355	(0.426)	0.000
Construction and Construction Materials	-0.546***	(0.201)	0.042	-0.303	(0.418)	-0.001	-0.574**	(0.264)	0.026
Steel Works Etc	-0.059	(0.262)	-0.010	-0.681	(0.470)	0.003	-1.342***	(0.321)	0.065
Fabricated Products and Machinery	-0.539**	(0.212)	0.038	-0.682	(0.424)	0.010	-0.510**	(0.218)	0.015
Electrical Equipment	-0.083	(0.237)	-0.007	-0.486	(0.401)	0.005	-0.695***	(0.194)	0.043
Automobiles and Trucks	0.402	(0.406)	0.000	-0.369	(0.530)	-0.003	-0.771**	(0.321)	0.026
Aircraft, ships, and railroad equipment	-0.412*	(0.238)	0.024	0.316	(0.472)	-0.006	-0.755***	(0.217)	0.053
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.866*	(0.448)	0.038	-1.003	(1.150)	0.018	-1.067**	(0.505)	0.040
Coal	-0.461	(0.482)	-0.001	-0.992	(1.153)	-0.005	-1.177*	(0.608)	0.020
Petroleum and Natural Gas	-0.757***	(0.250)	0.109	0.075	(0.601)	-0.013	-0.306	(0.253)	0.000
Utilities	-0.284	(0.184)	0.010	0.123	(0.365)	-0.013	-0.366*	(0.202)	0.015
Communication	-0.148	(0.145)	-0.003	-0.945**	(0.377)	0.039	-0.324**	(0.153)	0.008
Personal and Business Services	-0.377	(0.230)	0.012	-0.515	(0.565)	0.000	-0.373***	(0.136)	0.012
Business Equipment	-0.498*	(0.249)	0.021	-0.808	(0.660)	0.004	-0.427	(0.268)	0.007
Business Supplies and Shipping Containers	-0.117	(0.167)	-0.007	-0.450	(0.392)	0.003	-0.308*	(0.166)	0.011
Transportation	-0.092	(0.295)	-0.006	-0.076	(0.295)	-0.007	-0.257	(0.183)	0.004
Wholesale	-0.043	(0.120)	-0.004	-0.500	(0.392)	0.007	-0.360*	(0.187)	0.015
Retail	0.084	(0.221)	-0.008	-0.137	(0.424)	-0.007	0.127	(0.178)	-0.002
Restaurants, Hotels, Motels	0.015	(0.234)	-0.009	-0.161	(0.382)	-0.008	-0.494***	(0.178)	0.029
Banking, Insurance, Real Estate, Trading	-0.107	(0.147)	-0.002	0.044	(0.354)	-0.006	-0.404***	(0.126)	0.018
Others	-0.475**	(0.232)	0.030	0.288	(0.429)	-0.006	-0.594***	(0.203)	0.049

*** p<0.01, ** p<0.05, * p<0.1

$\Delta \bar{R}^2$ is the increase or decrease in adjusted R^2 from adding the exchange rate(s) into the regression.

the null hypothesis: $H_0 : \alpha_I^- = \alpha_I^+$ where I is the broad or major currency index. The F-statistics and P-values from the test are reported in the fourth column. Considering Table 20, we find that six industries have asymmetric exposure to the broad currency index, while only one industry has asymmetric exposure to the major currency index.

4.4 Symmetry Testing: Orthogonalized Linear Exposure

This section reports the results obtained from estimating Eq.(8) as well as the results from testing the null hypothesis that the orthogonalized linear exposure is symmetric.

4.4.1 Exposure to Euro and Yen

Table 22 reports the results of symmetry test of orthogonalized exposure to Euro and Japanese Yen. In the case of Euro, we find that we cannot reject the null hypothesis for any industry. On the other hand, we can reject the null hypothesis that the petroleum industry has symmetric exposure to the Japanese Yen.

4.4.2 Exposure to Broad and Major Currency Indices

Looking at Table 24 we can reject the null hypothesis that the exposure to the broad currency index is symmetric for five industries. On the other hand, we cannot reject the null hypothesis for any industry in the case of the major currency index.

In conclusion, we find that orthogonalization does not help uncover the asymmetry of exposure. After using the orthogonalization technique fewer industries show asymmetric exposure to currency movements. Moreover, the results are very sensitive to the choice of exchange rates. Even the broad and major currency indices, which are closely related, yield very different results.

Table 19: Yen and Euro Exchange Rate Exposure Symmetry Test

Industry	$\Delta€^+$		$\Delta€^-$		$\Delta¥^+$		$\Delta¥^-$		$\alpha_€^+=\alpha_€^-$		$\alpha_¥^+=\alpha_¥^-$		$\alpha_€^+=\alpha_€^-=0$		$\alpha_¥^+=\alpha_¥^-=0$	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue	Fstat	Pvalue	Fstat	Pvalue
Food Products	-0.056	(0.147)	-0.120	(0.148)	0.076	(0.130)	-0.035	(0.105)	0.069	0.793	0.382	0.537	0.567	0.568	0.201	0.818
Beer & Liquor	-0.120	(0.188)	-0.296	(0.205)	0.138	(0.186)	0.058	(0.172)	0.302	0.583	0.077	0.781	1.696	0.185	0.439	0.645
Tobacco Products	0.324	(0.237)	-0.449	(0.379)	0.137	(0.227)	0.039	(0.199)	2.106	0.148	0.084	0.773	1.126	0.325	0.254	0.776
Recreation	0.021	(0.192)	-0.037	(0.195)	0.044	(0.175)	0.261	(0.160)	0.035	0.852	0.705	0.402	0.020	0.980	1.493	0.226
Printing and Publishing	-0.032	(0.147)	0.012	(0.142)	0.150	(0.130)	0.186	(0.127)	0.039	0.843	0.034	0.854	0.025	0.975	2.003	0.137
Consumer Goods	0.125	(0.125)	0.033	(0.149)	-0.015	(0.127)	-0.067	(0.156)	0.189	0.664	0.054	0.817	0.597	0.551	0.120	0.887
Apparel	0.047	(0.183)	0.149	(0.218)	0.043	(0.170)	0.190	(0.156)	0.098	0.755	0.359	0.549	0.362	0.697	0.839	0.433
Healthcare, Medical Equipment, Pharmaceutical Products	-0.051	(0.132)	-0.179	(0.162)	0.070	(0.147)	0.070	(0.104)	0.315	0.575	0.000	1.000	0.813	0.444	0.371	0.691
Chemicals	-0.243**	(0.120)	0.116	(0.173)	-0.192	(0.131)	0.179	(0.119)	2.312	0.129	3.728	0.054	2.067	0.128	1.870	0.156
Textiles	-0.042	(0.237)	-0.011	(0.234)	-0.101	(0.208)	0.458**	(0.205)	0.007	0.935	2.981	0.085	0.021	0.979	2.505	0.083
Construction and Construction Materials	-0.149	(0.144)	-0.042	(0.170)	-0.092	(0.138)	0.126	(0.126)	0.192	0.661	1.221	0.270	0.648	0.523	0.655	0.520
Steel Works Etc	-0.245	(0.221)	-0.078	(0.247)	-0.230	(0.232)	0.200	(0.168)	0.194	0.660	1.673	0.197	0.857	0.425	0.886	0.413
Fabricated Products and Machinery	-0.346**	(0.155)	0.216	(0.164)	-0.003	(0.167)	-0.052	(0.130)	4.942	0.027	0.045	0.833	2.796	0.062	0.083	0.920
Electrical Equipment	0.037	(0.138)	-0.105	(0.147)	0.072	(0.126)	0.010	(0.113)	0.375	0.540	0.113	0.737	0.257	0.774	0.183	0.833
Automobiles and Trucks	0.130	(0.256)	0.213	(0.231)	-0.174	(0.203)	0.044	(0.179)	0.048	0.827	0.606	0.437	0.684	0.505	0.383	0.682
Aircraft, ships, and railroad equipment	0.076	(0.171)	0.187	(0.202)	-0.257	(0.183)	0.192	(0.143)	0.125	0.724	2.835	0.093	0.853	0.427	1.422	0.243
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.744**	(0.305)	0.005	(0.321)	-0.088	(0.299)	-0.115	(0.290)	2.190	0.140	0.003	0.954	3.285	0.039	0.177	0.838
Coal	-1.078***	(0.378)	-0.257	(0.505)	0.611	(0.430)	0.431	(0.296)	1.337	0.248	0.107	0.744	4.967	0.007	2.367	0.095
Petroleum and Natural Gas	-0.239	(0.185)	0.007	(0.203)	-0.273	(0.182)	0.223	(0.139)	0.596	0.440	3.548	0.060	0.937	0.393	1.810	0.165
Utilities	-0.109	(0.147)	-0.077	(0.177)	-0.047	(0.172)	0.064	(0.126)	0.015	0.902	0.231	0.631	0.464	0.629	0.146	0.865
Communication	0.058	(0.143)	0.050	(0.179)	0.175	(0.137)	-0.108	(0.118)	0.001	0.975	2.200	0.139	0.195	0.823	1.116	0.329
Personal and Business Services	0.037	(0.136)	0.101	(0.182)	0.054	(0.172)	-0.080	(0.142)	0.066	0.797	0.317	0.574	0.231	0.794	0.187	0.830
Business Equipment	-0.045	(0.179)	0.267	(0.217)	0.007	(0.214)	-0.196	(0.136)	0.925	0.337	0.533	0.466	0.773	0.462	1.084	0.339
Business Supplies and Shipping Containers	0.147	(0.126)	-0.010	(0.174)	-0.293**	(0.144)	0.066	(0.099)	0.402	0.527	3.487	0.063	0.759	0.469	2.086	0.126
Transportation	-0.018	(0.161)	0.207	(0.151)	0.001	(0.139)	0.047	(0.117)	0.757	0.385	0.050	0.824	1.041	0.354	0.089	0.915
Wholesale	-0.024	(0.132)	0.087	(0.152)	0.014	(0.141)	0.025	(0.112)	0.239	0.626	0.003	0.955	0.163	0.849	0.035	0.965
Retail	0.249*	(0.146)	0.256*	(0.154)	0.057	(0.153)	-0.033	(0.134)	0.001	0.979	0.143	0.706	4.914	0.008	0.076	0.927
Restaurants, Hotels, Motels	0.174	(0.175)	0.168	(0.174)	-0.135	(0.164)	-0.057	(0.126)	0.000	0.983	0.109	0.742	1.682	0.187	0.612	0.543
Banking, Insurance, Real Estate, Trading	0.266**	(0.118)	-0.157	(0.140)	-0.085	(0.135)	0.249**	(0.108)	4.270	0.040	3.085	0.080	2.713	0.068	2.661	0.071
Others	0.116	(0.135)	0.012	(0.149)	-0.182	(0.147)	0.076	(0.106)	0.204	0.652	1.645	0.200	0.433	0.649	0.856	0.426

*** p<0.01, ** p<0.05, * p<0.1

Table 20: Broad Currency Index Exposure Symmetry Test

Industry	1974 to 2008							
	ΔI^+		ΔI^-		$\alpha_I^+ = \alpha_I^-$		$\alpha_I^+ = \alpha_I^- = 0$	
	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue
Food Products	0.235	(0.175)	-0.432*	(0.249)	3.607	0.058	1.811	0.165
Beer & Liquor	0.211	(0.237)	-0.758**	(0.347)	3.909	0.049	2.379	0.094
Tobacco Products	0.909***	(0.316)	-1.324*	(0.700)	6.070	0.014	4.240	0.015
Recreation	-0.127	(0.315)	0.467	(0.319)	1.173	0.279	1.135	0.322
Printing and Publishing	0.011	(0.261)	0.296	(0.280)	0.367	0.545	0.800	0.450
Consumer Goods	0.517***	(0.156)	-0.545*	(0.285)	7.612	0.006	5.561	0.004
Apparel	-0.179	(0.271)	0.879***	(0.315)	4.365	0.037	4.234	0.015
Healthcare, Medical Equipment, Pharmaceutical Products	0.140	(0.179)	-0.212	(0.238)	0.960	0.328	0.480	0.619
Chemicals	-0.399**	(0.176)	0.044	(0.264)	1.427	0.233	2.918	0.055
Textiles	-0.384	(0.348)	0.700*	(0.395)	2.979	0.085	1.644	0.194
Construction and Construction Materials	-0.412*	(0.218)	0.038	(0.285)	1.083	0.299	2.140	0.119
Steel Works Etc	-0.752**	(0.312)	-0.148	(0.502)	0.751	0.387	4.012	0.019
Fabricated Products and Machinery	-0.875***	(0.205)	0.359	(0.290)	8.780	0.003	9.303	0.000
Electrical Equipment	-0.020	(0.199)	-0.040	(0.236)	0.003	0.956	0.031	0.969
Automobiles and Trucks	0.051	(0.449)	0.135	(0.382)	0.013	0.910	0.153	0.858
Aircraft, ships, and railroad equipment	0.089	(0.224)	0.288	(0.377)	0.147	0.702	0.648	0.523
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.587***	(0.415)	-0.284	(0.638)	2.173	0.141	9.455	0.000
Coal	-1.629***	(0.457)	0.206	(0.818)	2.734	0.099	7.703	0.001
Petroleum and Natural Gas	-0.641***	(0.243)	0.324	(0.331)	4.053	0.045	3.472	0.032
Utilities	-0.025	(0.194)	-0.320	(0.295)	0.496	0.482	0.814	0.444
Communication	0.236	(0.186)	0.123	(0.243)	0.097	0.755	1.438	0.239
Personal and Business Services	-0.207	(0.207)	0.456	(0.297)	2.308	0.129	1.224	0.295
Business Equipment	-0.274	(0.246)	0.033	(0.342)	0.364	0.546	0.742	0.477
Business Supplies and Shipping Containers	0.061	(0.199)	-0.285	(0.246)	0.851	0.357	0.689	0.503
Transportation	0.184	(0.203)	0.190	(0.307)	0.000	0.990	1.084	0.339
Wholesale	-0.119	(0.186)	0.160	(0.273)	0.510	0.475	0.264	0.768
Retail	0.430**	(0.201)	0.535*	(0.306)	0.059	0.809	6.760	0.001
Restaurants, Hotels, Motels	0.355	(0.236)	-0.204	(0.335)	1.353	0.245	1.128	0.325
Banking, Insurance, Real Estate, Trading	0.087	(0.170)	0.337	(0.222)	0.565	0.453	1.985	0.139
Others	0.029	(0.188)	-0.024	(0.286)	0.017	0.895	0.012	0.988

*** p<0.01, ** p<0.05, * p<0.1

Table 21: Major Currency Index Exposure Symmetry Test

Industry	1974 to 2008							
	ΔI^+		ΔI^-		$\alpha_I^+ = \alpha_I^-$		$\alpha_I^+ = \alpha_I^- = 0$	
	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue
Food Products	0.110	(0.190)	-0.218	(0.164)	1.228	0.268	0.887	0.413
Beer & Liquor	0.165	(0.223)	-0.376	(0.231)	2.038	0.154	1.331	0.265
Tobacco Products	0.769**	(0.311)	-0.679*	(0.402)	5.454	0.020	3.191	0.042
Recreation	-0.061	(0.285)	0.292	(0.222)	0.643	0.423	1.007	0.366
Printing and Publishing	-0.072	(0.222)	0.304*	(0.172)	1.204	0.273	1.775	0.171
Consumer Goods	0.341**	(0.152)	-0.140	(0.182)	2.791	0.096	2.592	0.076
Apparel	-0.044	(0.246)	0.538***	(0.201)	2.299	0.130	4.350	0.014
Healthcare, Medical Equipment, Pharmaceutical Products	0.129	(0.164)	-0.189	(0.160)	1.279	0.259	0.721	0.487
Chemicals	-0.328**	(0.157)	0.116	(0.175)	2.447	0.118	2.236	0.108
Textiles	-0.264	(0.353)	0.563**	(0.265)	2.448	0.118	2.279	0.104
Construction and Construction Materials	-0.414**	(0.196)	0.122	(0.182)	2.753	0.098	2.298	0.102
Steel Works Etc	-0.513*	(0.298)	-0.122	(0.317)	0.539	0.463	2.486	0.085
Fabricated Products and Machinery	-0.642***	(0.197)	0.243	(0.187)	7.258	0.007	5.332	0.005
Electrical Equipment	0.004	(0.186)	-0.035	(0.166)	0.016	0.898	0.025	0.975
Automobiles and Trucks	-0.183	(0.384)	0.309	(0.242)	0.772	0.380	0.863	0.423
Aircraft, ships, and railroad equipment	-0.045	(0.200)	0.370*	(0.224)	1.321	0.251	1.523	0.219
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.955**	(0.430)	-0.523	(0.455)	0.320	0.572	5.728	0.004
Coal	-0.802*	(0.458)	-0.067	(0.476)	0.847	0.358	2.113	0.122
Petroleum and Natural Gas	-0.388	(0.252)	0.107	(0.210)	1.632	0.202	1.196	0.303
Utilities	-0.131	(0.160)	-0.066	(0.183)	0.051	0.822	0.641	0.528
Communication	-0.006	(0.175)	0.132	(0.158)	0.246	0.620	0.405	0.667
Personal and Business Services	-0.019	(0.188)	0.096	(0.184)	0.131	0.717	0.150	0.861
Business Equipment	-0.059	(0.248)	-0.017	(0.216)	0.011	0.916	0.048	0.953
Business Supplies and Shipping Containers	0.056	(0.164)	-0.111	(0.155)	0.386	0.535	0.256	0.774
Transportation	-0.008	(0.202)	0.271	(0.186)	0.694	0.405	1.355	0.259
Wholesale	-0.099	(0.175)	0.151	(0.163)	0.769	0.381	0.450	0.638
Retail	0.328*	(0.190)	0.410**	(0.186)	0.065	0.799	7.124	0.001
Restaurants, Hotels, Motels	0.242	(0.231)	0.056	(0.199)	0.264	0.608	0.860	0.424
Banking, Insurance, Real Estate, Trading	0.006	(0.154)	0.323**	(0.138)	1.674	0.197	3.338	0.037
Others	-0.110	(0.172)	0.138	(0.174)	0.710	0.400	0.365	0.694

*** p<0.01, ** p<0.05, * p<0.1

Table 22: Orthogonalized Yen and Euro Exchange Rate Exposure Symmetry Test

Industry	$\Delta€^+$		$\Delta€^-$		$\Delta¥^+$		$\Delta¥^-$		$\alpha_€^+=\alpha_€^-$		$\alpha_¥^+=\alpha_¥^-$		$\alpha_€^+=\alpha_€^-=0$		$\alpha_¥^+=\alpha_¥^-=0$	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue	Fstat	Pvalue	Fstat	Pvalue
Food Products	-0.180	(0.150)	-0.272*	(0.143)	0.152	(0.123)	0.022	(0.113)	0.150	0.699	0.530	0.467	3.585	0.029	0.844	0.431
Beer & Liquor	-0.223	(0.186)	-0.460**	(0.213)	0.142	(0.172)	0.198	(0.191)	0.542	0.462	0.038	0.845	4.209	0.016	1.193	0.304
Tobacco Products	0.141	(0.236)	-0.538	(0.377)	0.148	(0.221)	0.077	(0.217)	1.662	0.198	0.041	0.839	1.016	0.363	0.386	0.680
Recreation	-0.139	(0.190)	-0.278	(0.205)	0.126	(0.172)	0.361**	(0.151)	0.186	0.666	0.875	0.350	1.700	0.184	3.594	0.029
Printing and Publishing	-0.251*	(0.150)	-0.171	(0.149)	0.303**	(0.124)	0.261*	(0.134)	0.119	0.730	0.047	0.828	2.501	0.084	5.464	0.005
Consumer Goods	-0.036	(0.133)	-0.082	(0.149)	0.055	(0.122)	0.037	(0.187)	0.044	0.834	0.005	0.943	0.229	0.796	0.161	0.851
Apparel	-0.251	(0.194)	-0.013	(0.222)	0.133	(0.164)	0.350**	(0.170)	0.495	0.482	0.744	0.389	0.953	0.387	2.725	0.067
Healthcare, Medical Equipment, Pharmaceutical Products	-0.226	(0.142)	-0.320**	(0.160)	0.064	(0.138)	0.182*	(0.108)	0.154	0.695	0.414	0.520	4.275	0.015	1.614	0.201
Chemicals	-0.415***	(0.121)	-0.039	(0.181)	-0.096	(0.125)	0.249**	(0.124)	2.310	0.129	3.178	0.076	6.759	0.001	2.085	0.126
Textiles	-0.239	(0.222)	-0.181	(0.235)	0.073	(0.202)	0.606***	(0.203)	0.025	0.875	2.843	0.093	1.178	0.309	4.988	0.007
Construction and Construction Materials	-0.373**	(0.149)	-0.243	(0.174)	0.019	(0.131)	0.272**	(0.134)	0.267	0.605	1.669	0.197	5.026	0.007	2.129	0.120
Steel Works Etc	-0.316	(0.221)	-0.443*	(0.248)	-0.097	(0.229)	0.273	(0.175)	0.118	0.732	1.236	0.267	3.383	0.035	1.225	0.295
Fabricated Products and Machinery	-0.452***	(0.155)	-0.038	(0.168)	0.088	(0.163)	-0.007	(0.139)	2.599	0.108	0.159	0.690	4.806	0.009	0.146	0.864
Electrical Equipment	-0.178	(0.147)	-0.327**	(0.140)	0.161	(0.121)	0.125	(0.126)	0.419	0.518	0.034	0.853	4.639	0.010	1.701	0.184
Automobiles and Trucks	-0.076	(0.251)	0.057	(0.235)	0.020	(0.199)	0.086	(0.182)	0.127	0.721	0.056	0.813	0.064	0.938	0.120	0.887
Aircraft, ships, and railroad equipment	-0.097	(0.175)	0.007	(0.206)	-0.054	(0.172)	0.234	(0.153)	0.108	0.742	1.239	0.267	0.173	0.841	1.165	0.313
Precious Metals, Non-Metallic, and Industrial Metal Mining	-0.817**	(0.318)	-0.275	(0.322)	-0.074	(0.297)	-0.030	(0.316)	1.093	0.296	0.008	0.930	4.788	0.009	0.049	0.952
Coal	-0.912**	(0.379)	-0.728	(0.521)	0.566	(0.404)	0.409	(0.315)	0.063	0.802	0.083	0.774	5.444	0.005	2.154	0.118
Petroleum and Natural Gas	-0.305	(0.191)	-0.150	(0.213)	-0.270	(0.175)	0.279*	(0.154)	0.217	0.641	4.185	0.042	2.203	0.112	2.147	0.118
Utilities	-0.204	(0.150)	-0.169	(0.179)	-0.046	(0.157)	0.121	(0.138)	0.018	0.894	0.537	0.464	1.759	0.174	0.392	0.676
Communication	-0.140	(0.144)	-0.076	(0.178)	0.199	(0.138)	-0.021	(0.127)	0.058	0.810	1.224	0.269	0.836	0.434	1.049	0.351
Personal and Business Services	-0.214	(0.150)	-0.165	(0.183)	0.117	(0.166)	0.063	(0.158)	0.034	0.853	0.048	0.827	1.844	0.160	0.387	0.680
Business Equipment	-0.239	(0.195)	0.014	(0.222)	0.113	(0.206)	-0.108	(0.150)	0.553	0.458	0.605	0.437	0.818	0.442	0.330	0.719
Business Supplies and Shipping Containers	-0.048	(0.132)	-0.125	(0.183)	-0.168	(0.135)	0.151	(0.103)	0.088	0.767	2.964	0.086	0.435	0.647	1.545	0.215
Transportation	-0.210	(0.159)	0.047	(0.152)	0.105	(0.134)	0.149	(0.120)	0.979	0.323	0.046	0.830	0.902	0.407	1.477	0.230
Wholesale	-0.201	(0.139)	-0.137	(0.165)	0.105	(0.133)	0.137	(0.118)	0.068	0.795	0.028	0.867	1.927	0.147	1.156	0.316
Retail	0.011	(0.143)	0.061	(0.152)	0.177	(0.140)	0.086	(0.150)	0.041	0.840	0.145	0.704	0.111	0.895	1.371	0.255
Restaurants, Hotels, Motels	-0.030	(0.174)	0.006	(0.168)	-0.031	(0.151)	0.079	(0.135)	0.015	0.902	0.227	0.634	0.015	0.985	0.170	0.843
Banking, Insurance, Real Estate, Trading	0.059	(0.115)	-0.266*	(0.146)	0.034	(0.127)	0.308***	(0.119)	2.457	0.118	2.045	0.154	1.665	0.191	3.744	0.025
Others	-0.111	(0.144)	-0.114	(0.147)	-0.116	(0.147)	0.176	(0.113)	0.000	0.988	2.043	0.154	0.818	0.442	1.324	0.267

*** p<0.01, ** p<0.05, * p<0.1

4.5 Rolling Regression

To help visualize the exchange rate exposure, we estimate the traditional linear exposure to the broad currency index using rolling regression with the window size of 60 months. We choose food, printing, construction, auto, precious metal, coal, petroleum, communication, transportation, wholesale, and financial industries as examples. The results are plotted in Figures 5 through 15. Notice how exposure fluctuates over time in all industries with perhaps one exception; the precious metal industry remained negatively exposed to the currency index almost the entire period. Another interesting characteristic of exposure is that its standard deviation tends to increase towards the end of the sample period. This is clear in the food, auto, coal, and communication industries.

Table 23: Orthogonalized Major Index Exchange Rate Exposure Symmetry Test

	1974 to 2008							
Industry	ΔI^+		ΔI^-		$\alpha_I^+=\alpha_I^-$		$\alpha_I^+=\alpha_I^-=0$	
	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue
Food Products	-0.165	(0.191)	-0.505***	(0.170)	1.238	0.267	7.186	0.001
Beer & Liquor	-0.151	(0.229)	-0.633**	(0.261)	1.325	0.250	4.903	0.008
Tobacco Products	0.360	(0.317)	-0.897**	(0.423)	3.785	0.052	2.246	0.107
Recreation	-0.372	(0.258)	-0.213	(0.244)	0.135	0.713	2.637	0.073
Printing and Publishing	-0.399*	(0.207)	-0.051	(0.178)	1.131	0.288	2.627	0.074
Consumer Goods	-0.051	(0.159)	-0.353*	(0.202)	0.932	0.335	2.479	0.085
Apparel	-0.530**	(0.258)	0.224	(0.225)	3.243	0.073	2.109	0.123
Healthcare, Medical Equipment, Pharmaceutical Products	-0.280	(0.176)	-0.470***	(0.166)	0.416	0.519	9.819	0.000
Chemicals	-0.601***	(0.152)	-0.274	(0.194)	1.218	0.270	14.480	0.000
Textiles	-0.477	(0.322)	0.181	(0.280)	1.655	0.199	1.098	0.335
Construction and Construction Materials	-0.792***	(0.198)	-0.269	(0.191)	2.470	0.117	14.560	0.000
Steel Works Etc	-0.662**	(0.292)	-0.791**	(0.321)	0.061	0.805	10.250	0.000
Fabricated Products and Machinery	-0.803***	(0.192)	-0.314	(0.191)	2.263	0.133	16.380	0.000
Electrical Equipment	-0.465**	(0.192)	-0.399**	(0.172)	0.045	0.832	11.110	0.000
Automobiles and Trucks	-0.432	(0.362)	-0.108	(0.247)	0.369	0.544	1.448	0.236
Aircraft, ships, and railroad equipment	-0.363*	(0.204)	0.003	(0.246)	0.894	0.345	2.024	0.133
Precious Metals, Non-Metallic, and Industrial Metal Mining	-1.141***	(0.435)	-0.969**	(0.491)	0.047	0.829	10.310	0.000
Coal	-0.679	(0.446)	-0.933*	(0.517)	0.093	0.760	5.407	0.005
Petroleum and Natural Gas	-0.573**	(0.252)	-0.209	(0.233)	0.783	0.377	4.853	0.008
Utilities	-0.438***	(0.164)	-0.167	(0.196)	0.774	0.380	6.291	0.002
Communication	-0.319*	(0.170)	-0.146	(0.174)	0.349	0.555	3.489	0.032
Personal and Business Services	-0.485**	(0.196)	-0.371*	(0.197)	0.115	0.734	9.223	0.000
Business Equipment	-0.397	(0.272)	-0.541**	(0.236)	0.109	0.742	6.703	0.001
Business Supplies and Shipping Containers	-0.276*	(0.163)	-0.416**	(0.169)	0.248	0.618	7.477	0.001
Transportation	-0.380*	(0.195)	0.004	(0.195)	1.262	0.262	2.601	0.075
Wholesale	-0.358**	(0.180)	-0.285	(0.177)	0.058	0.811	6.023	0.003
Retail	-0.154	(0.189)	0.100	(0.194)	0.588	0.444	0.340	0.712
Restaurants, Hotels, Motels	-0.251	(0.230)	-0.207	(0.213)	0.013	0.909	2.037	0.132
Banking, Insurance, Real Estate, Trading	-0.355**	(0.150)	0.026	(0.149)	2.285	0.131	3.227	0.041
Others	-0.509***	(0.174)	-0.153	(0.175)	1.431	0.232	7.322	0.001

*** p<0.01, ** p<0.05, * p<0.1

Table 24: Orthogonalized Broad Index Exchange Rate Exposure Symmetry Test

Industry	1974 to 2008							
	ΔI^+		ΔI^-		$\alpha_I^+=\alpha_I^-$		$\alpha_I^+=\alpha_I^-=0$	
	Coef.	s.e.	Coef.	s.e.	Fstat	Pvalue	Fstat	Pvalue
Food Products	-0.130	(0.208)	-0.806***	(0.223)	3.518	0.061	9.062	0.000
Beer & Liquor	-0.215	(0.285)	-1.014***	(0.335)	2.305	0.130	7.223	0.001
Tobacco Products	0.544	(0.378)	-1.347**	(0.605)	4.783	0.029	2.529	0.081
Recreation	-0.574*	(0.325)	-0.463	(0.311)	0.043	0.836	4.664	0.010
Printing and Publishing	-0.551*	(0.295)	-0.275	(0.243)	0.357	0.550	4.346	0.014
Consumer Goods	0.045	(0.183)	-0.786***	(0.258)	4.875	0.028	5.375	0.005
Apparel	-0.953***	(0.324)	0.184	(0.300)	4.477	0.035	4.778	0.009
Healthcare, Medical Equipment, Pharmaceutical Products	-0.277	(0.205)	-0.697***	(0.212)	1.417	0.235	10.050	0.000
Chemicals	-0.954***	(0.197)	-0.496*	(0.255)	1.402	0.237	22.660	0.000
Textiles	-0.934**	(0.388)	0.035	(0.368)	2.265	0.133	3.523	0.030
Construction and Construction Materials	-1.099***	(0.263)	-0.581**	(0.252)	1.381	0.241	20.400	0.000
Steel Works Etc	-1.196***	(0.374)	-1.076**	(0.440)	0.031	0.861	14.040	0.000
Fabricated Products and Machinery	-1.428***	(0.226)	-0.460*	(0.252)	5.852	0.016	31.480	0.000
Electrical Equipment	-0.684***	(0.245)	-0.630***	(0.219)	0.018	0.893	15.020	0.000
Automobiles and Trucks	-0.526	(0.491)	-0.366	(0.328)	0.050	0.824	2.474	0.086
Aircraft, ships, and railroad equipment	-0.510**	(0.255)	-0.198	(0.342)	0.365	0.546	3.576	0.029
Precious Metals, Non-Metallic, and Industrial Metal Mining	-2.111***	(0.468)	-1.010*	(0.568)	1.626	0.203	17.370	0.000
Coal	-1.908***	(0.517)	-0.963	(0.731)	0.747	0.388	14.030	0.000
Petroleum and Natural Gas	-1.183***	(0.282)	-0.062	(0.311)	5.002	0.026	11.150	0.000
Utilities	-0.414*	(0.235)	-0.482*	(0.265)	0.025	0.873	6.117	0.002
Communication	-0.171	(0.205)	-0.331	(0.227)	0.193	0.660	2.309	0.101
Personal and Business Services	-0.929***	(0.236)	-0.381	(0.259)	1.651	0.200	14.990	0.000
Business Equipment	-0.941***	(0.297)	-0.679**	(0.315)	0.251	0.617	13.510	0.000
Business Supplies and Shipping Containers	-0.550**	(0.229)	-0.579**	(0.232)	0.006	0.941	10.430	0.000
Transportation	-0.369	(0.228)	-0.239	(0.269)	0.090	0.764	3.292	0.038
Wholesale	-0.644***	(0.209)	-0.472**	(0.239)	0.205	0.651	11.540	0.000
Retail	-0.303	(0.228)	0.025	(0.267)	0.597	0.440	1.050	0.351
Restaurants, Hotels, Motels	-0.175	(0.259)	-0.751**	(0.299)	1.478	0.225	5.095	0.007
Banking, Insurance, Real Estate, Trading	-0.389**	(0.194)	-0.239	(0.202)	0.199	0.656	4.772	0.009
Others	-0.577**	(0.226)	-0.442*	(0.245)	0.111	0.739	9.210	0.000

*** p<0.01, ** p<0.05, * p<0.1

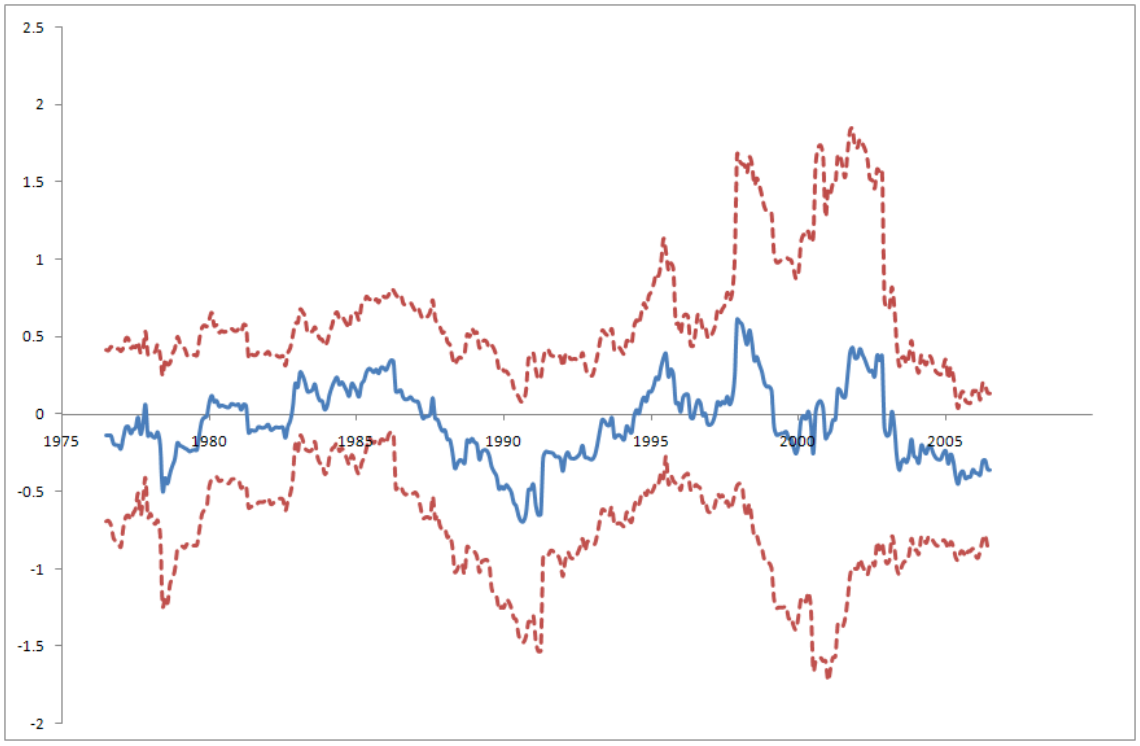

Figure 5: Time series plot of broad currency index exposure of the food industry and its 95% confidence interval using traditional linear regression.

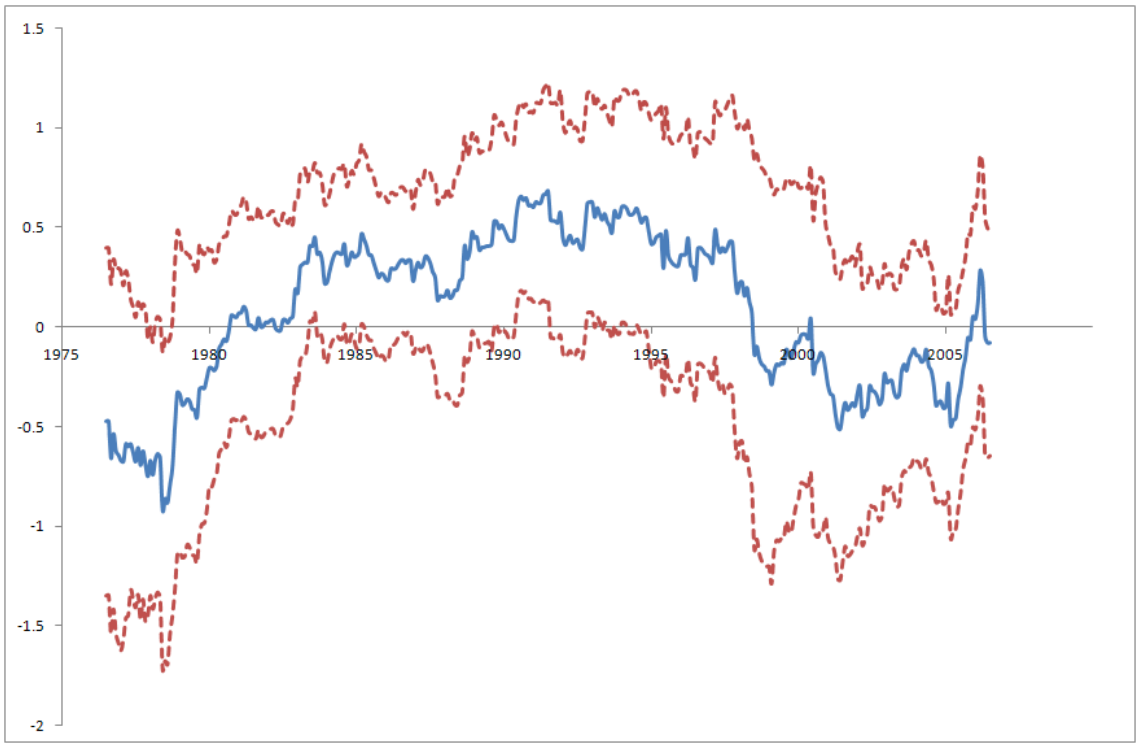

Figure 6: Time series plot of broad currency index exposure of the printing and publishing industry and its 95% confidence interval using traditional linear regression.

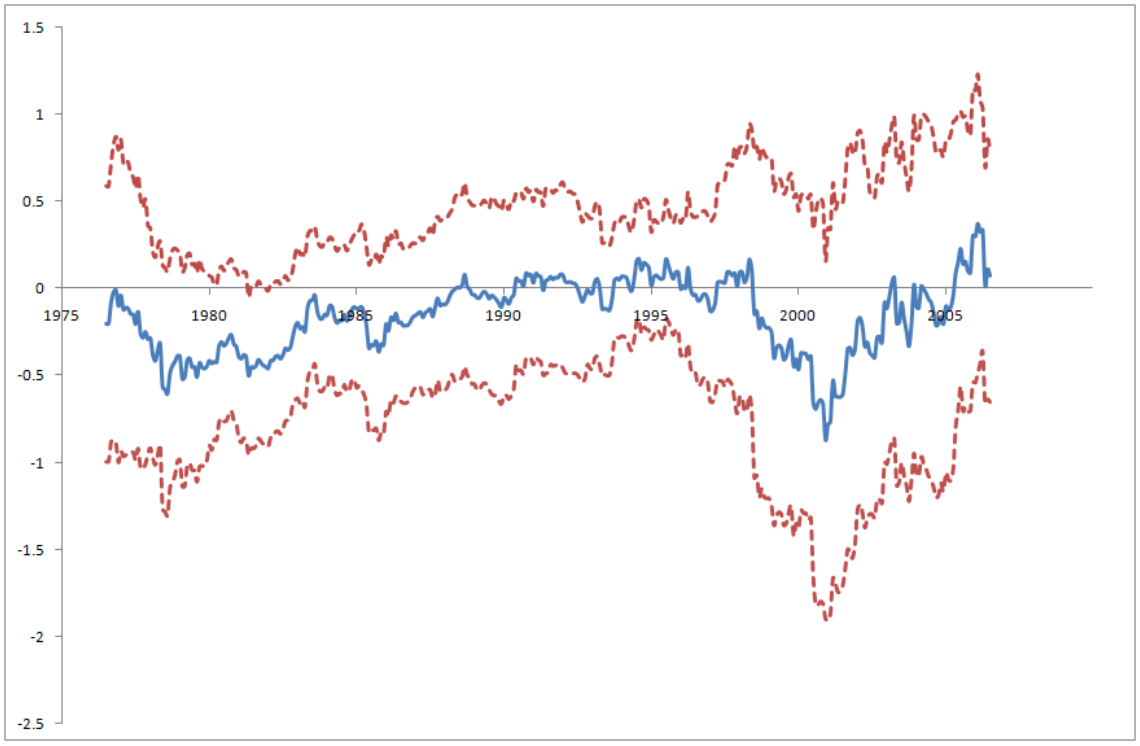

Figure 7: Time series plot of broad currency index exposure of the construction industry and its 95% confidence interval using traditional linear regression.

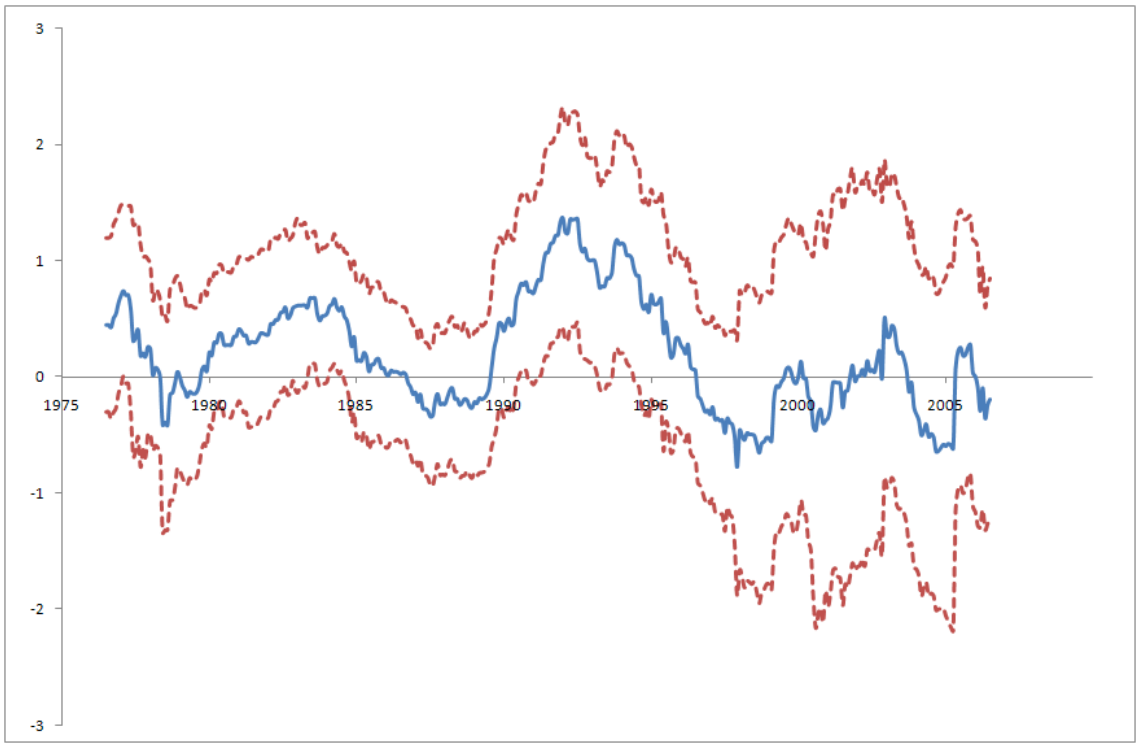

Figure 8: Time series plot of broad currency index exposure of the auto industry and its 95% confidence interval using traditional linear regression.

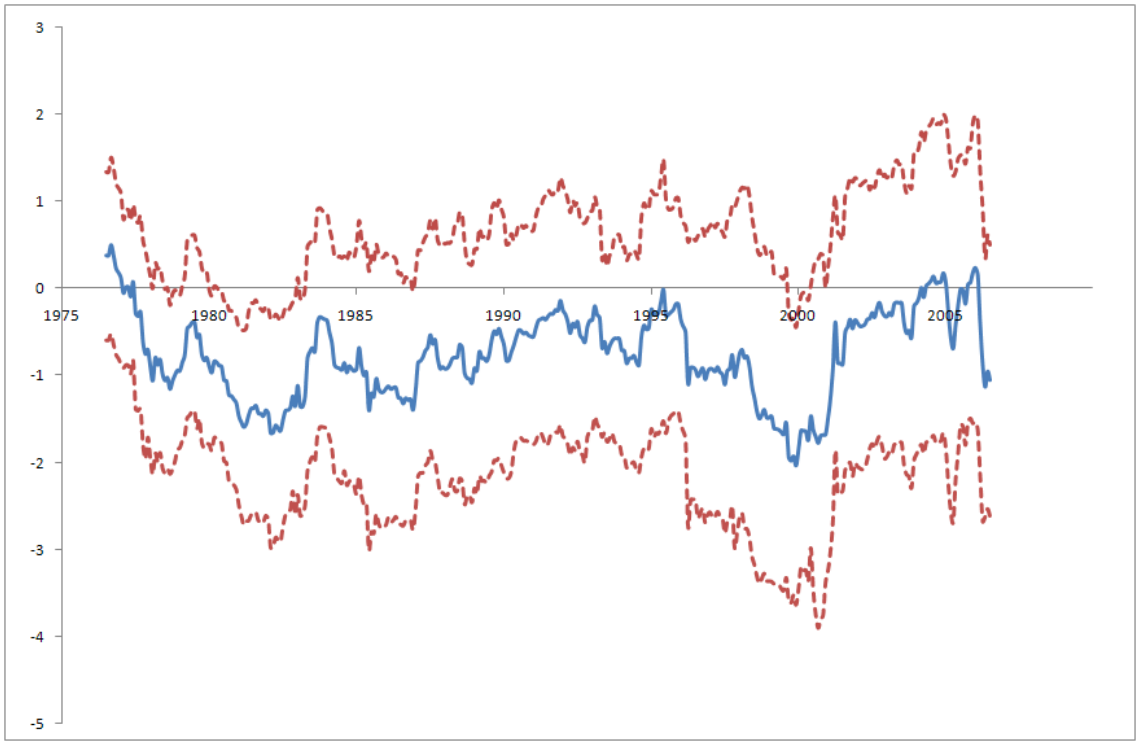

Figure 9: Time series plot of broad currency index exposure of the precious metal industry and its 95% confidence interval using traditional linear regression.

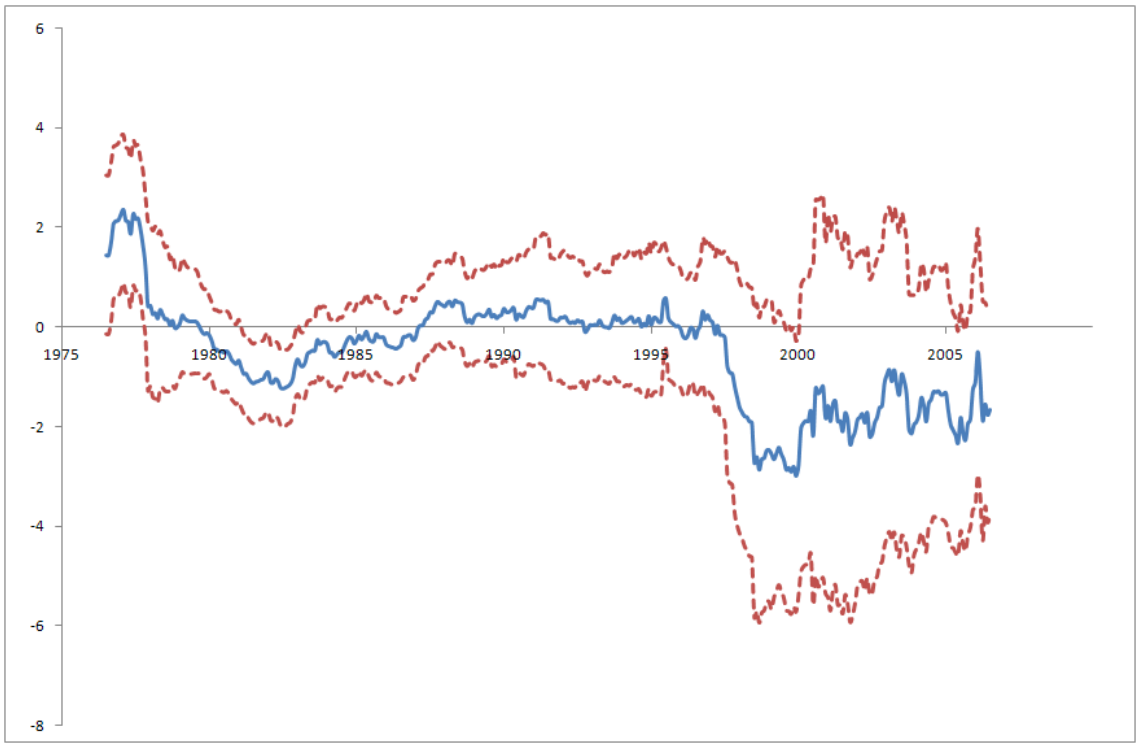

Figure 10: Time series plot of broad currency index exposure of the coal industry and its 95% confidence interval using traditional linear regression.

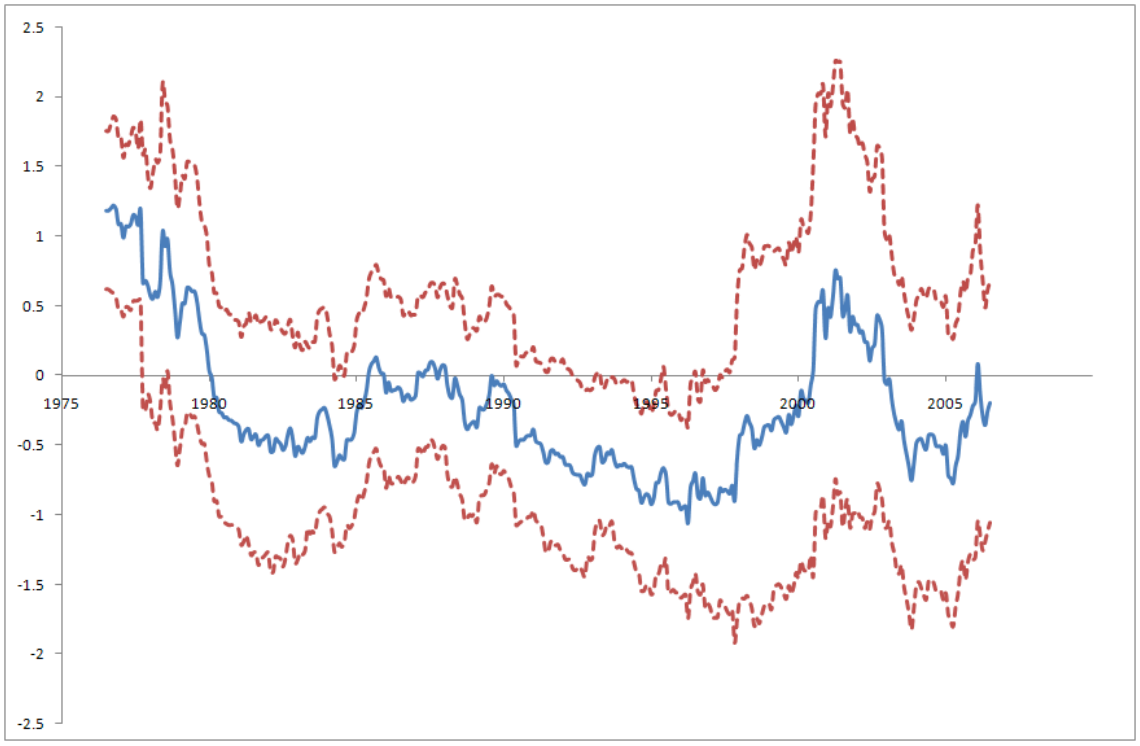

Figure 11: Time series plot of broad currency index exposure of the petroleum and natural gas industry and its 95% confidence interval using traditional linear regression.

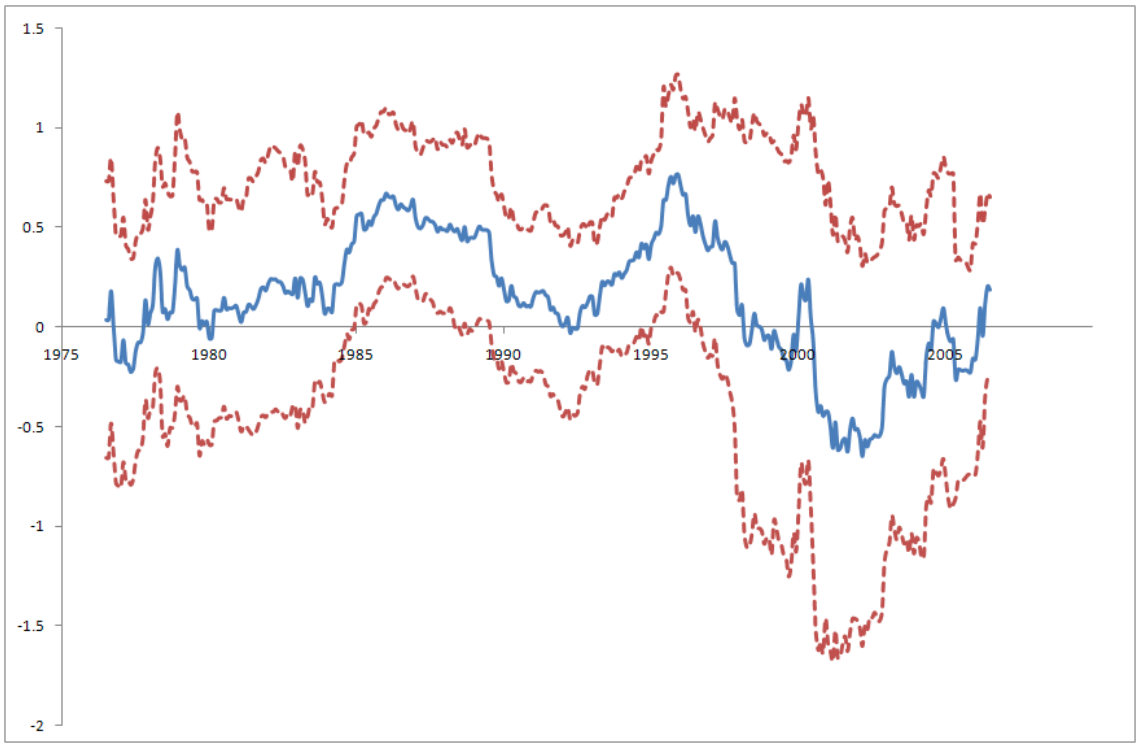

Figure 12: Time series plot of broad currency index exposure of the communication industry and its 95% confidence interval using traditional linear regression.

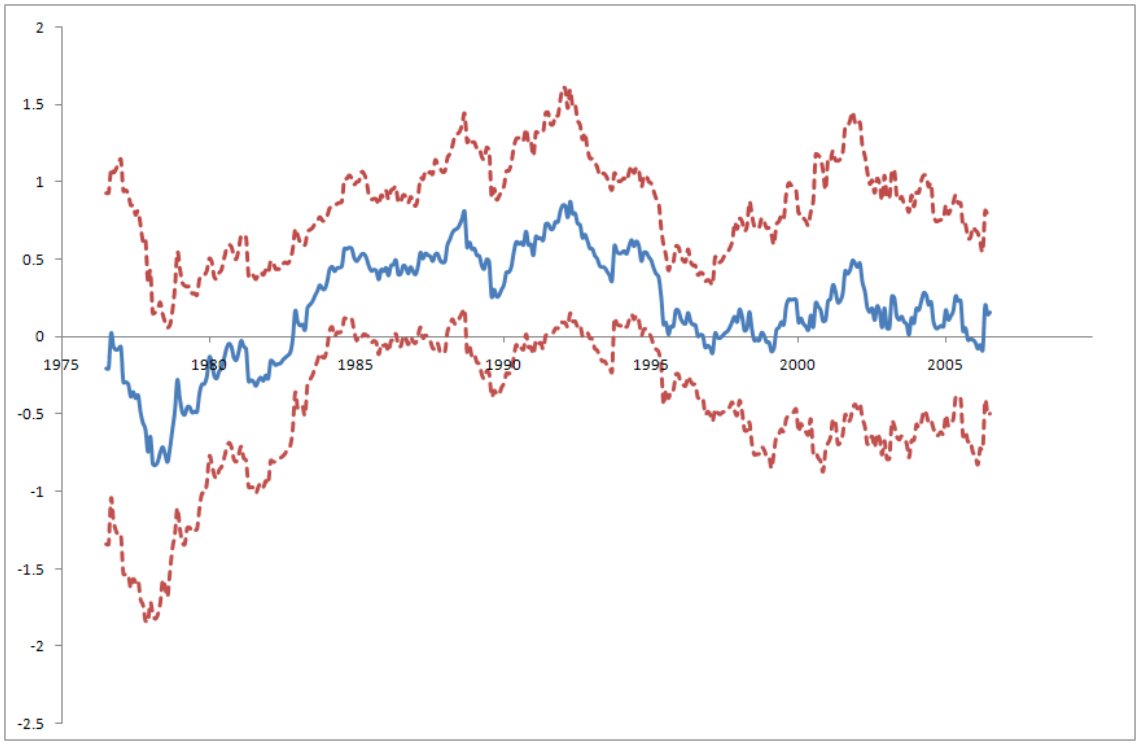

Figure 13: Time series plot of broad currency index exposure of the transportation industry and its 95% confidence interval using traditional linear regression.

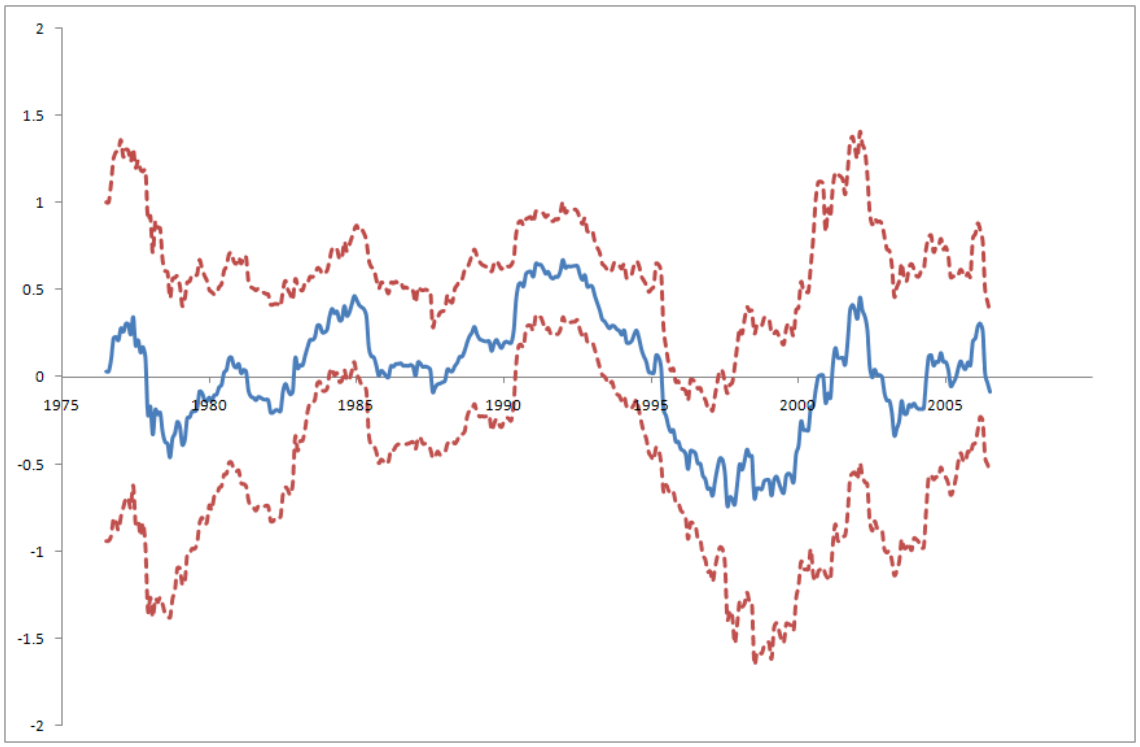

Figure 14: Time series plot of broad currency index exposure of the wholesale industry and its 95% confidence interval using traditional linear regression.

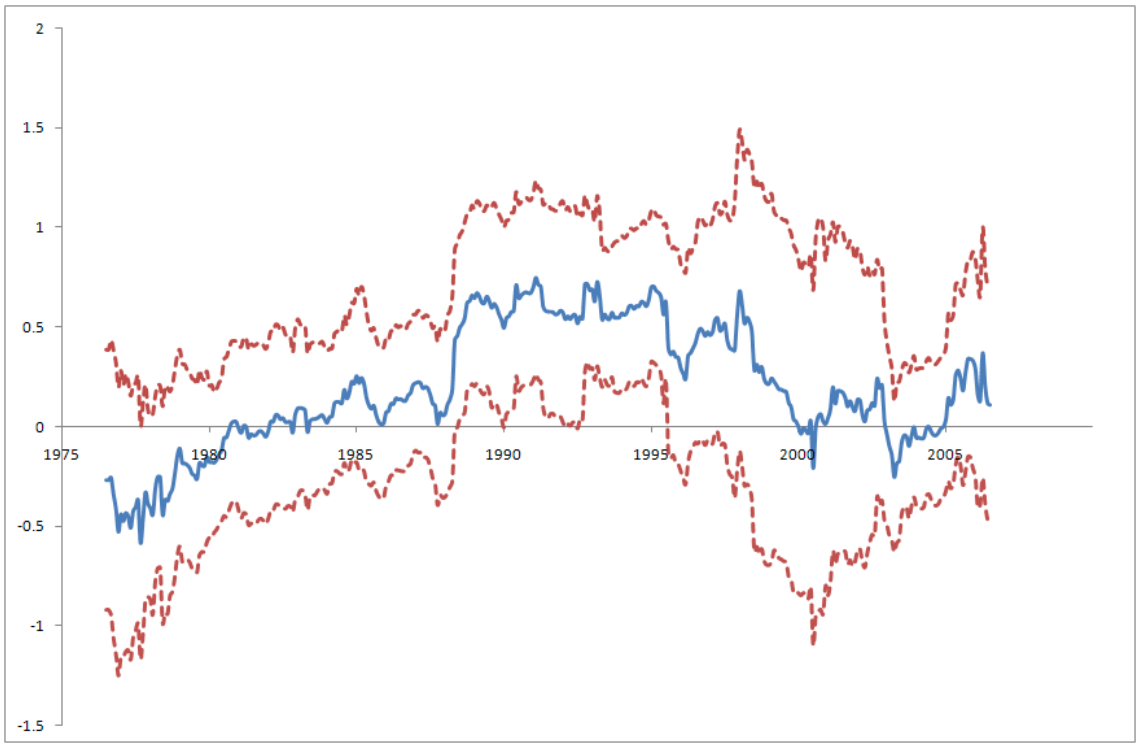

Figure 15: Time series plot of broad currency index exposure of the financial industry and its 95% confidence interval using traditional linear regression.

CHAPTER V

CONCLUSION

When we use traditional linear model to estimate exchange rate exposure, we find that only a small number of industries are statistically or economically exposed. The orthogonalization method described in Section 2.3 helps uncover more exposure; we find that more industries are exposed and the size of exposure is generally bigger. However, when we test the symmetry of exposure by subdividing testing the hypothesis that the exposures during appreciations and depreciations are equal, we find that we cannot reject the hypothesis at 5% significant level for most industries. We also obtain similar results when using orthogonalized model.

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